Popular Astronomy

Vol. XLIII, No. 6 JUNE-JULY, 1935 Whole No. 426

The Spectrum of Nova Herculis in its Decline

By DEAN B. McLAUGHLIN

In a previous paper* the writer has given a summary of the changes of the spectrum of Nova Herculis from its discovery until about March 1, 1935. The present paper completes the general description of the spectrum until it became too faint to be observed with the equipment of the Observatory of the University of Michigan.

Changes from Discovery to March 1

To recapitulate briefly, the spectrum of the nova in mid-December resembled that of α Cygni (class cA2). Most of the absorption lines, especially those of hydrogen and Fe_{II}, were flanked on the red side by emission, and the whole absorption spectrum was displaced toward the violet by an amount which decreased from 500 to 180 km/sec during the first few days. About December 21 the spectrum quickly changed to class cF5, resembling that of ϵ Aurigae, and the emission bands disappeared as the star approached maximum light. As the light faded the emission bands reappeared and widened somewhat as the absorption spectrum increased its displacement to —300 km/sec. Early in January, before the cF5 spectrum had weakened very much, a new absorption spectrum appeared. It consisted chiefly of diffuse lines of hydrogen, Fe_{II}, Ca_{II}, and Ti_{II}, with displacement about —700 km/sec. A corresponding large increase of width of the emission bands occurred. This spectrum reached its greatest development near the end of January, by which time the cF5 spectrum had weakened very considerably, though its strongest lines were still conspicuous. From February 1 to March 1 the diffuse spectrum faded slowly, the Ti_{II} lines disappearing completely, those of Fe_{II} weakening considerably, and those of hydrogen and Ca_{II} fading only slightly. Meanwhile, the auroral and nebular emissions of O_I appeared late in December and increased rather steadily until they ranked with $H\alpha$ and the D emission of Na_I as the most conspicuous features of the visual spectrum. At the subordinate minima of light the emission bands of Fe_{II} and Ca_{II} showed two maxima, one on each edge of the core of the band. This structure became a permanent feature of the nebular and auroral lines.

About March 1 the spectrum of the nova was constituted as follows:

(1). The faded remnants of the cF5 spectrum, chiefly fine absorption lines of Ti_{II}, Ca_{II}, and hydrogen, with traces of some of the strong-

*Popular Astronomy, **43**, 265, 1935.

er lines of Fe_{II}. The displacement had increased to —380 km/sec.

(2). The somewhat faded diffuse absorption spectrum, consisting of lines of Ca_{II}, Fe_{II}, and hydrogen, with displacement increased to —800 km/sec.

(3). Conspicuous emission bands of Fe_{II} and Ca_{II}, consisting of two narrow well separated maxima (displacements —300 and +300 km/sec) with fainter broad wings on each side.

(4). Broad, strong, and rather structureless emission bands of hydrogen, with the region between the two absorption components much depressed, as if by diffuse absorption.

(5). Very diffuse and variable weak absorption at $H\alpha$ and $H\beta$, with displacement about —1400 km/sec, with corresponding extensions of the emission bands to red and violet.

(6). Very vague and faint absorption at about λλ 4060 and 4250. The origin is uncertain; the former may be due to strongly displaced lines 4097, 4103, N_{III}.

(7). Strong nebular and auroral lines of O_I (6300, 6363, 5577).

Changes of the Spectrum during March

About March 1 the broad wings of the Fe_{II} emission bands faded rather abruptly, and simultaneously the strong diffuse absorption of Fe_{II} weakened. The lines of Ca_{II} and Na_I showed similar changes. The fading of these features continued, and hardly a trace remained by March 25. The cores of the emission bands of Fe_{II} and Na_I remained, though with greatly reduced intensity, but even the cores of the Ca_{II} emission bands disappeared.

The first undoubted Orion absorption lines appeared on March 3. This B-type spectrum showed a displacement of about —500 km/sec. The first lines observed were λλ 3995, N_{II}, 4026, He_I, 4144, He_I, 4267, C_{II}, and 4416, O_{II}. The line 4472, He_I, was not clearly seen at first on account of blending with 4468, Ti_{II}, of the cF5 spectrum. The positions and intensities of the Orion lines were subject to considerable fluctuations. Thus, on March 9, the displacement was only —300 km/sec, and distinct emission was then present at 3995, 4026, and 4267. A few days later the velocity was again close to —500 km/sec. In the main the Orion lines became more intense with the passage of time.

Faint Orion lines with displacement of the order of —1100 km/sec were seen on a few plates early in March. On March 23 they flashed up from near invisibility to greater strength than the first Orion spectrum in less than 24 hours and faded to their former obscurity in an equally short interval. On March 26 they were again strong, but in less than three hours they nearly disappeared, and simultaneously the velocity of the first Orion spectrum increased by nearly 100 km/sec. This was the date of the last maximum of the nova. The strongly displaced Orion lines were not again conspicuous, but the first Orion spectrum increased in intensity until, at the end of March, it comprised more than forty lines of which approximately half were due to O_{II}.

At no time was strong emission of He_I present, except at D_3 and 4713. The latter line was doubtless reinforced by the broad diffuse "4640" emission. Other Orion emissions which were fairly conspicuous at times were 4267, C_{II}, and possibly 4416, O_{II}, although this latter band falls at the position of permitted and forbidden lines of Fe_{II}.

Early in March a faint but well defined emission band appeared about λ 4660. This is very definitely not the well-known Wolf-Rayet band "4640." In all probability it is the nebular band 4658, of unknown origin, which appeared in Nova Pictoris. This band increased in intensity until it rivalled Hγ after March 19.

A very broad and faint band without distinct edges appeared in the same region from the middle to the end of March. This is undoubtedly "4640," a composite of radiations of N_{III} and C_{III}. Support for this belief is furnished by the increased conspicuousness of a similar hazy band symmetrical about Hδ during that time; this was evidently 4097-4103, N_{III}. Various other emissions became strong at about the same time; among them were an unidentified band at about 4250, and several radiations of N_{II}, $\lambda\lambda$4995, 5680, and 5950. The band at 5680 became a rival of Hα for supremacy in the visual region.

The emissions characteristic of the gaseous nebulae continued to increase in strength. These were 6300, 6363, O_I, and 5755, N_{II}. The principal nebular lines at $\lambda\lambda$ 4959, 5007, did not appear. Contrasted with the increase of 6300 and 6363 was the fading of the auroral line, 5577, O_I, accompanying the Fe_{II} emission in its decline. All the radiations just mentioned showed marked duplicity, with little or no light in the centers of the bands.

The extreme violet extension of the Hβ emission increased during March from a faint smudge to near equality with the remainder of the band, and a corresponding extension of the band appeared on its red edge. In terms of velocity the Hβ band on March 20 extended from —1400 to +1400 km/sec. The absorption on the violet edge of the new extension never became more than a very diffuse smear. The strong second absorption thus appeared within the emission band instead of at its edge. In the previous paper it was stated that the hydrogen emission never showed clearly the double structure which characterized Fe_{II}, Ca_{II}, and the nebular radiations. About March 5, however, near a minimum of light, Hα became distinctly double. At that time the other hydrogen bands did not show this structure, but at the next deep minimum, March 20, Hβ developed a "dipped" profile, and Hδ showed it, though less clearly. The Hγ band was too much complicated by Fe_{II} emission to permit observation of this structure at that line. With the rise of the star to its last maximum these structures faded again, although the Fe_{II} emission bands continued to show duplicity.

The hydrogen absorption lines were subject to complex changes, which were seen best at Hδ where the lines are not blended with other features and the spectrum is usually well exposed and the dispersion high enough to show the absorption components resolved. On March 6

a strong absorption line appeared between the first (—400 km/sec) and second (—800 km/sec) absorptions. The record lacks continuity, due to interruptions by clouds, but it appears that the new line coalesced with the —800 km/sec line on March 12 and then detached itself and moved towards the —400 km line. The —800 km line then faded and narrowed, becoming remarkably sharp, while the —400 km line became stronger and wider. On March 26 the intermediate moving absorption nearly coalesced with the —400 km line. On that one night only a very fine line with displacement —1000 km/sec accompanied each of the hydrogen lines. On March 29 the intermediate absorption had moved towards the violet again and was nearly midway between the first and second absorption lines. These changes recall those exhibited by Nova Pictoris at a corresponding stage of its development.

The Fe_{II} emission lines were rather inconspicuous about the middle of March, but at the minimum of light about March 20 they flashed into prominence again, each band appearing as a pair of equal narrow emission lines. At the same time a number of *single* emission lines appeared at many places in the spectrum. All these could be readily matched with forbidden lines of Fe_{II} displaced to the violet by the same amount as the violet components of the double permitted lines. With the increase of light towards the last maximum the forbidden lines practically disappeared and the permitted lines again became inconspicuous.

Last Observations and Summary of Spectral Changes

Cloudy weather came at the end of March; when it cleared there could be no doubt that the end of the long maximum had come. On April 3 the nova had faded to magnitude 6.3, and a remarkable change had occurred in its spectrum. The permitted and forbidden emissions of Fe_{II} had again flashed into view, owing to the withdrawal of the strong continuous spectrum. The permitted lines were, so to speak, caught in the act of changing from near equality of their two components to the marked inequality exhibited by the forbidden lines. Rough intensity ratios of violet to red components were 2:1 for the permitted and 5:1 for the forbidden lines. The hydrogen bands had now developed the double structure distinctly, but with the components nearly equal. The emission bands at 4250, 4658, and 4995 had suffered a great loss of intensity. The Orion absorption lines were still very strong and diffuse.

In twenty-four hours the nova faded about a magnitude and a half; then it paused for two days with only a slight diminution of light. On April 6 the change in the permitted emission lines of Fe_{II} was apparently complete; like the forbidden lines, they showed the violet components five times as strong as the red. The hydrogen bands had developed the double structure very strongly, but with the components still nearly equal. All absorption lines had disappeared, with the possible exception of very vague and faint remnants of those of hydrogen superimposed on the bands. The emission bands of N_{II} at 4995, 5680, and 5950 had

vanished, but the forbidden emission of N_{II} at 5755 was still conspicuous. Only a few days earlier the band 5680 had far exceeded 5755. The most conspicuous features of the visible spectrum were Hα and the two nebular lines of O_I. The auroral line and those of Fe_{II} were quite faint, and only their violet components were found. The most curious feature of the spectrum on that date was the appearance of faint bits of emission in the precise positions previously occupied by the absorption lines of Ti_{II} and Ca_{II} of the cF5 spectrum. This suggests that the increase of the violet components of the permitted emission lines of Fe_{II} was due to the substitution of emission for absorption. The forbidden lines had no absorption and so showed the violet components much the stronger at an earlier date, as did the forbidden radiations of O_I.

With the further fading of the nova, observations of its spectrum at Ann Arbor became impossible. The changes of the spectrum from shortly after discovery until the cessation of observations at Ann Arbor are summarized in the two tables below. Table 1 gives "intensities" of absorption features and Table 2 gives similar data for the emissions. The data given are only "qualitatively quantitative" representing, on an arbitrary scale, the "conspicuousness" of the features on well exposed spectrograms. Figures in brackets indicate values based upon published reproductions or descriptions of spectra, or upon interpolations. The remaining data are based on the Ann Arbor plates, but are subject to revision. They are intended to serve the purpose, temporarily, of indicating the general character of the changes which took place.

TABLE 1

CHANGES OF ABSORPTION FEATURES

Date		α Cyg (V = −180)	ϵ Aur (V = −300)		Diffuse Abs. (V = −700)			Orion Absorptions V = −500	V = −1100
			Met.	Hydr.	Hydr.	Fe_{II}	Ti_{II}		
Dec.	15	[20]							
	17	20	0	0					
	20	[5]	[10]	[0]					
	22	[0]	[20]	[1]					
	24		25	2	0	0	0		
	27		20	4	1	0	0		
	30		20	5	2	1	0		
Jan.	5		18	6	5	2	0		
	10		15	5	8	5	4		
	20		10	4	20	10	6		
	30		5	4	20	8	4		
Feb.	5		2	5	18	7	2		
	10		2	4	18	6	2		
	20		1	4	15	5	1	0	0
March	1		1	4	15	3	0	2	0
	10		1	4	15	2	0	3	1
	20		tr	6	5	0	0	6	5
	29		tr	10	3	0	0	9	1
April	3		0	2	2	0	0	10	0
	6		e 1	0?	0	0	0	0	0

tr = trace; e = emission.

Plates V and VI show the changes of the spectrum from February 7 to April 6, completing the sequence of spectra which was begun in the previous paper. The more important features are indicated. The limitations of half-tone reproduction do not permit the exhibition of all features of the original spectrograms. The last strip of Plate V and the last two of Plate VI were made with a wider slit than usual, hence the resolution of detail is limited.

TABLE 2

CHANGES OF EMISSION FEATURES

Date		Hydr.	Fe II	[Fe II]	6300 6363 [O I] for 5684 read 5680.)	5577 [O I] (Auror.)	5990 6020 6090	4995 5680 N II	4658 Neb.	"4640"
Dec.	15	12	5		[0]	[0]	..			
	17	12	5		0	0	tr			
	20	[5]	[1]		[0]	[0]	..			
	22	[0]	[0]		[0]	[0]	..			
	24	[1]	[0]		..	..	..			
	27	10	6		4	3	3	tr?		
	30	20	10		6	5	5	tr?		
Jan.	5	30	12		7	6	3	tr		
	10	40	15		8	6	2	1		
	20	50	20		10	7	0	2		
	30	50	20		12	8	0	3		
Feb.	5	50	15		12	8		3		
	10	50	15		15	8		3		
	20	50	12		18	8		5	0	
Mar.	1	50	12		20	8		5	1	0
	10	50	10	0	22	6		10	6	2
	20	40	10	5	25	4		12	18	10
	29	30	5	2	[28]	[3]		15	20	10
Apr.	3	20	8	8	..	..		4	10	3
	6	20	10	10	30	2		0	3	0

On April 6, although it was more than three months since maximum light and nearly seven magnitudes fainter, the nova showed no trace of the principal nebular lines, 4959, 5007, O III. The spectrum on that date was remarkable for the number of forbidden lines of Fe II. In several other respects Nova Herculis was unusual. The small velocity shown by the first spectrum carried with it an unusual narrowness of the band structures. Consequently bands close together could be resolved and faint bands showed more clearly, so that some previously unrecorded ones were found. Equally noteworthy was the failure of 4686, He II, to appear, at least strongly enough to be recognized on the Ann Arbor plates. The appearance of faint emission features in the positions of absorption lines as the nova faded is believed to be without precedent.* The spectrum on April 6 was very much like that of the famous southern variable η Carinae, which is merely a "long-winded" nova.

OBSERVATIONS OF MAGNITUDE

In a previous note (POPULAR ASTRONOMY, **43**, 93, 1935) observations of the nova up to J.D. 7818 were given. Estimates of magnitude have

*This refers to novae. It has been noted in R Coronae Borealis.

been continued, and all obtained to date are given in Table 3. The comparison stars used up to J.D. 7899 are the same as before, with some additions. Designations of the stars are those used by the writer, and are not to be confused with those given in H.A.C. 332. The given magnitudes of all stars fainter than f were derived by the writer from an elaborate intercomparison by the method of estimates, and are adjusted as nearly as possible to the scale of the Revised Harvard Photometry. They are, however, only provisional. Observations made after J.D. 7900 are referred to comparison stars given in H.A.C. 332, and the magnitudes were taken from that source.

COMPARISON STARS

	M
a = γ Drac	2.42
c = β Drac	2.99
d = ι Herc	3.79
e = ξ Drac	3.90
f = BD +43°2892	5.11
g = BD +45°2638	5.92
i = BD +45°2627	6.27
o = BD +46°2426	7.1
p = BD +45°2652	7.9

TABLE 3

OBSERVATIONS OF NOVA HERCULIS

J.D.	Est.	Mag.	Notes	J.D.	Est.	Mag.	Notes
7820.47	a 4± N 6± c	2.65:	p, tw	7869.91	c 7 N 3 d	3.55	c
20.97	a 0.3 N 4.7 c	2.36		70.78	c 8.7 N 1.3 d	3.69	YW
25.48	a 2.7 N 7.3 c	2.57	tw				
25.91	a 8.3 N 1.7 c	2.89	m, W	73.79	c 8.5 N 1.5 d	3.67	
26.48	a 7.3 N 2.7 c	2.84		76.79	c 9.5 N 0.5 d	3.75	Y
				77.81	c 7.8 d 2.2 N	4.02	Y?
26.84	a 6.7 N 3.3 c	2.80	W	77.81	d 2.3 N 7.7 f	4.09	
27.47	a 6.5 N 3.5 c	2.8	c, tw†	77.81	e 0.5 N 9.5 f	3.96	
29.89	a 3.5 N 6.5 c	2.62	m, YW				
31.87	c 3.3 N 6.7 d	3.25		78.92	d 2.0 N 8.0 f	4.05	c
32.47	a 6.8 c 3.2 N	3.3	tw†	79.64	d 2.3 N 7.7 f	4.09	L, g
				79.78	d 3.0 N 7.0 f	4.19	m, Y?
32.89	c 6.7 N 3.3 d	3.53		79.84	d 3.5 N 6.5 f	4.25	
36.81	c 2.3 N 7.7 d	3.17		81.78	d 6.5 N 3.5 f	4.65	m†, c
39.91	a 7.7 N 2.3 c	2.86	YW				
40.92	a 6.7 N 3.3 c	2.80	(h) YW	81.83	d 6.8 N 3.2 f	4.69	m†, tR
46.88	c 0.3 N 9.7 d	3.02	m, YW	83.75	d 8 N 2 f	4.85	m, tR
				84.79	d 6.5 N 3.5 f	4.65	m
48.93	c 7.5 N 2.5 d	3.59		85.67	d 6.8 N 3.2 f	4.69	
50.98	c 8 N 2 d	3.63	d	85.87	d 7.3 N 2.7 f	4.75	m
52.97	c 3.7 N 6.3 d	3.29	m				
53.85	c 3.7 N 6.3 d	3.29	m, YW	87.66	d 0.5 N 9.5 f	3.85	
54.90	c 4 N 6 d	3.31	c	87.78	d 2.3 N 7.7 f	4.09	m
				88.71	d 3.8 N 6.2 f	4.29	
56.96	c 1.7 N 8.3 d	3.13	YW	88.77	d 5.5 N 4.5 f	4.52	
57.85	c 3 N 7 d	3.23	c†, p	90.64	d 4.7 N 5.3 f	4.41	L, h
57.92	c 1 N 9 d	3.07	(h)				
60.82	c 1.5 N 8.5 d	3.11	YW	90.81	d 6.5 N 3.5 f	4.65	
63.88	c 7.7 N 2.3 d	3.61	Y	95.75	g 4.5 N 0.5 i	6.23	
				96.90	o 4.5 N 0.5 p	7.8	F
64.83	c 7.5 N 2.5 d	3.59		98.83	o 5.0 p 0.7 N	8.0	F
64.94	c 8.3 N 1.7 d	3.65		99.66	o 5.0 p 2.5 N	8.3	F
67.81	c 6.7 N 3.3 d	3.53	YW				

J.D.	Est.	Mag.	Notes
7902.87	e 1 N, N 2 g*	9.8	12
	N 6 n, N 2 k*		
06.82	e 3 N, g 1 N*		
	N 0.5 k, N 3.5n*	10.0	12
09.81	k 4 N, m 1.5 N*		
	N 1 n, N 4.5 o*	10.5	12
7910.72	k 6 N, l 4 N*		
	m 3.5 N, n 2 N*		
	N 2.5 o, N 4.5 p*	10.75	12
12.81	n 5.5 N, N 3.5 p*		
	N 2 q*	11.10	12
14.84	q 2.5 N, N 3 r*	11.6:	12, c
17.71	r 5 N*	12.1:	12
22.82	r 11 N*	12.7:	12

NOTES

c.....clouds near
d..... dawn
g..... good
h..... haze
L..... low
m..... moonlight
p..... poor
tw..... twilight
()..... slight effect
†.....strong effect
* comparison star designations HAC 332
F.....finder of 37-inch reflector
12.....12-inch refractor
W..... white
YW.....yellowish white
Y..... yellow
tR.....tinged with red

During the first two or three months of its greatest brilliancy Nova Herculis seemed to promise a repetition of the slow decline of Nova Pictoris, but having maintained its brightness to the point of exhaustion it suddenly dropped from sight early in April. It thus shows a very close parallel with Nova Aurigae of 1891-2, which remained at the fifth magnitude for three months before plunging to obscurity. One is tempted to suggest keeping a close watch of Nova Herculis to detect the beginning of a rise to a new maximum, which would complete the duplication of the light curve of Nova Aurigae. If this is to happen it may be expected during the summer of this year. At the date of writing, the nova is hardly a magnitude brighter than before the outburst. What has happened once *can* happen again, and the second maximum, if it occurs, may be as bright as the eighth magnitude.

THE OBSERVATORY, UNIVERSITY OF MICHIGAN, MAY 3, 1935.

NOTE ADDED MAY 18.—The nova has brightened approximately two magnitudes in the past ten days. A photometric comparison with star n (HAC 332) gives the magnitude of the nova as 10.8 on J.D. 7940.74. D. B. McL.

The Scorpion

Upon the hearth of hills the Scorpion burns,—
Dim embers of its vivid summer fire;
Antares flickers faintly in the dusk,
As one by one the lingering coals expire.

No scarlet bough need mark the summer's end;
No earth-bound leaf need hint of winter's scars.
Far west in dying sparks, eternal sign,
Descends the ageless omen of the stars.

FRANCES MORTON O'NEILL.

The Athens (Ala.) Meteorite

By STUART H. PERRY and C. C. WYLIE

The stone when received from the finder weighed 264 grams, perfect except for a slight chipping at one end caused by its impact upon the earth. One or two grams had been removed from that spot, so its original weight when it fell may have been 267 or 268 grams. It is covered with a black crust which is practically intact.

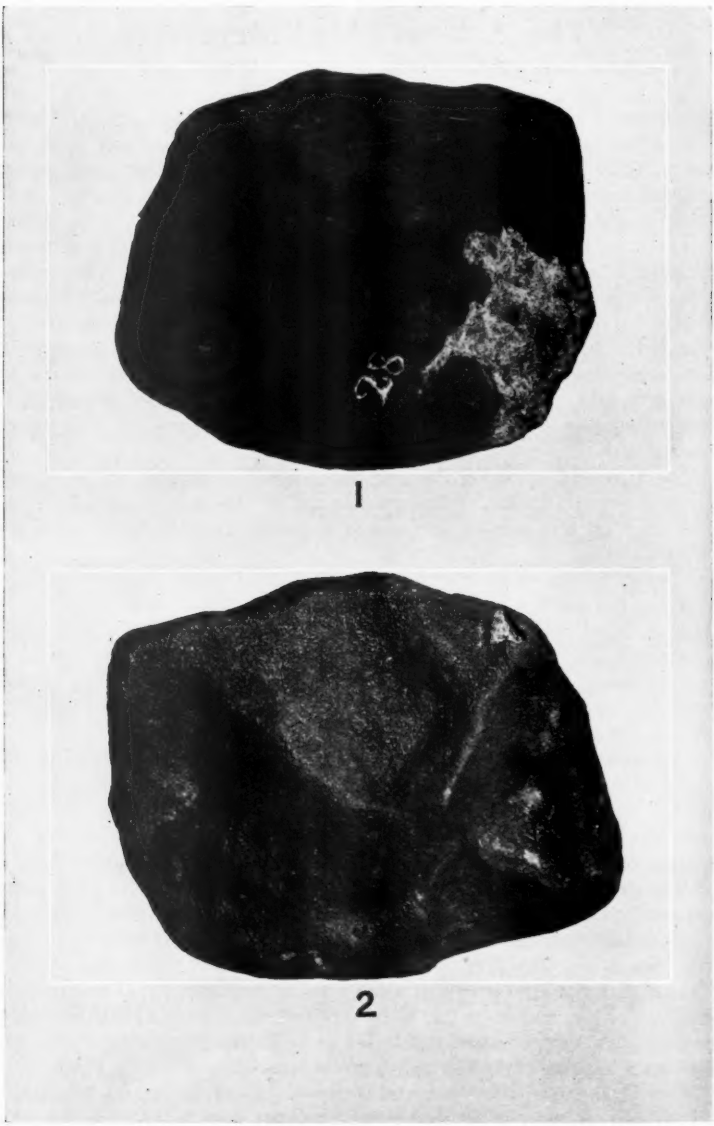
The mass is of an irregularly rounded form, appearing almost quadrangular in outline in most positions, but it is bounded roughly by five sides instead of six. Its greatest dimensions are 5, 5, 5, and 6.5 centimeters. The side toward the observer in Figure 1 presents a slightly rounded, smoothly crusted surface, slightly crazed but without pitting. The same description applies to the side on which the stone rests, as photographed. The third or upper side, as shown in the photograph, and the smaller side forming the right end, are less regular and somewhat pitted.

The fifth side, opposing the four above mentioned, is shown in Figure 2. It is very irregular, with deep pits and prominent cusps and ridges. The crust on this side is thicker and in places appears finely wrinkled or scoriaceous.

Distinct evidences of drift in the crust around edges and corners suggest that the portion bounded by the smooth rounded surfaces was forward in flight. This conclusion is strengthened by the fact that a small spot about half a centimeter square at the edge of the irregular area and adjoining one of the smooth sides, broken in flight, shows a partial secondary crust with distinct evidence of flowage of the fused material around the edge from the smooth side.

The stone is a chondrite, prevalently gray in color, consisting of chondrules and fragments of chondrules in a finely fragmentary groundmass. No trace of veining was observed. The chondrules are very abundant with many of large size, some oval or rounded, others of angular or irregular contours. A smoothly sawed surface about 3 by 2 centimeters, obtained in making thin sections, shows four or five conspicuously large olivine chondrules of a dark greenish color, two of which attain dimensions of 1.5 centimeters. The mass exhibits a distinct cataclastic structure, the angular and irregular areas and smaller fragmentary material giving it a breccia-like appearance. The groundmass is friable, and even the large olivine chondrules tend to crumble in sawing, leaving a surface that suggests an irregular slaty cleavage. The stone may be classified as a gray breccia-like chondrite (Cgb).

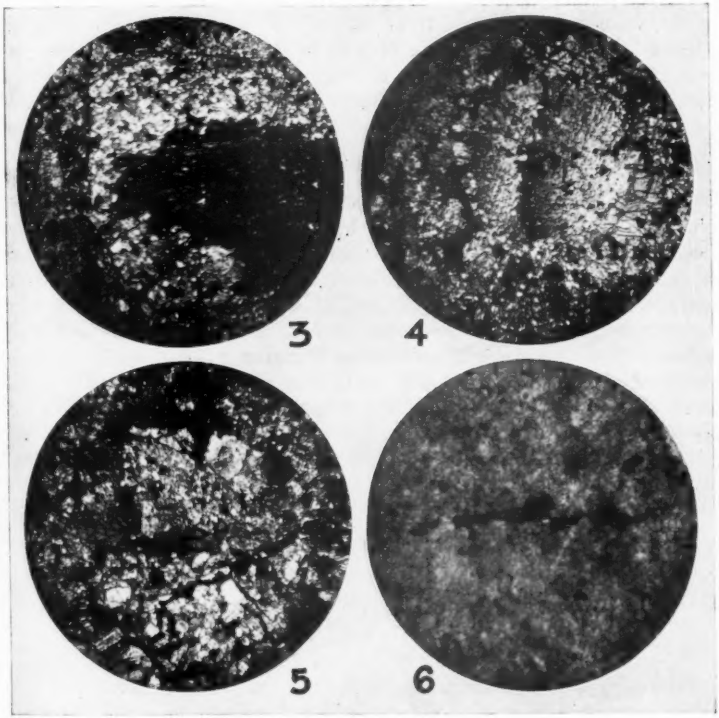
Metallic inclusions are not conspicuous. Under a hand-glass small masses of troilite may be seen fairly evenly distributed through the groundmass, though few of them are large enough to be noticeable to the eye. Iron appears sparingly in minute grains, mostly in the ground-



1. Forward Side of Mass, showing smooth bounding surfaces.
2. Rear Side, showing deep pitting and thickened crust.

mass, though under the microscope it is also found in the chondrules.

Owing to the friability of the material the preparation of sections was difficult, but two were obtained which afford a satisfactory basis for study. Figure 3 shows part of one of the large angular chondrules referred to, in which the olivine exhibits a banded structure of elongated crystals in parallel rows. The banded portion is surrounded by a mottled area of granular olivine, apparently resulting from a mechanical breaking down of the banded olivine into minute angular fragments.



3. Banded Olivine Crystals (at extinction) surrounded by granular olivine; x20, crossed Nicols.
4. Chondrule of Enstatite showing fibrous fan-shaped group; x40, crossed Nicols.
5. Stringer of Apatite (center), x40, crossed Nicols.
6. Stringer of Troilite in groundmass; x40, plane light.

Chondrules of enstatite are also present, much smaller, usually spherical, with the characteristic eccentrically radiating fibrous structure. An example is shown in Figure 4.

Mr. W. Harold Tomlinson, who made the sections and photographs,

makes the following observations upon a quantitative study of the component materials:

"The olivine is most abundant, measurement on numerous fields showing the proportion of olivine to enstatite to be between 1½ and 2 to one. The proportion might appear even larger, but many olivine chondrules carry considerable enstatite, and the banded and other crystals of olivine often carry considerable enstatite inclusions. Other chondrules occur showing mixtures of olivine and pyroxene, or of ortho- and clinopyroxenes. Anorthite is rather uniformly distributed through the mass in small amounts. The feldspar occurs also as small stringers. [See Figure 5.] Granular apatite is present to the amount of about two per cent. The amount of metallic minerals is small, troilite and chromite occurring in about equal proportions. Noteworthy features are the large angular greenish olivine chondrules and the relative abundance of chromite."

As suggested by Mr. Tomlinson, the amount of olivine apparent to the eye would indicate a larger proportion than his estimate which takes account of the distribution revealed by a study of thin sections. On the smoothed spot 3 by 2 centimeters, before referred to, the four or five large olivine chondrules of themselves occupy approximately half the surface.

A preliminary analysis was made by Mr. R. R. Kountz under the direction of Dr. Louis Waldbauer of the Department of Chemistry of the University of Iowa. About a gram of material obtained in making the sections was used. Because of the small amount, a spectrographic analysis was run and the following elements identified—Aluminum, Iron, Cobalt, Nickel, Magnesium, Calcium, Sodium, and Potassium. The quantitative data are as follows:

Silicon dioxide (SiO_2)	25.80%
Iron oxide (Fe_2O_3)	43.19
Aluminum oxide (Al_2O_3)	14.41
Nickel oxide (NiO)	5.22
Calcium oxide (CaO)	1.73
Magnesium oxide (MgO)	8.51
Sodium oxide (Na_2O) and Potassium oxide (K_2O)	1.14

The observed phenomena attending the fall were summarized in a paper appearing in POPULAR ASTRONOMY for October, 1933. Detonations were heard to the northeast of the point of fall, but they did not attract general attention. The stone was reported noticeably warm when picked up immediately after striking. These and other facts reported in the previous paper suggest: (1) a high angle of fall for the meteor, coming from the northeast; (2) that no large masses reached the earth, but that other small stones fell; and (3) that the meteor was of relatively low velocity.

The name "Athens" has been chosen for this meteorite, which is preserved in the collection of one of the authors (Mr. Perry), at Adrian, Michigan.

Solar Saros Series

By ALEXANDER POGO

On page VII of the Introduction to Oppolzer's *Canon der Finsternisse*,[1] the following statistical data can be found concerning the average numbers, per century, of the principal types of solar eclipses:

Partial eclipses	83.8
Annular "	77.3
Ann.-total "	10.5
Total "	65.9
All solar "	237.5

The study of saros series and of exeligmos[2] curves requires, however, an additional investigation of the relative frequency of transitional eclipses which may occur on the opening (P') and closing (P'') dates of the series, and in the initial and final stages of the runs of umbral eclipses. Some of the statistical results concerning transitional eclipses are given in Tables I and II.

In the case of about one half of one per cent of partial solar eclipses, the oblique penumbra fails to touch the surface in high latitudes, on account of flattening; in the saros series, these invisible eclipses may occur either at the beginning of the initial run of penumbral eclipses, or at the end of the terminal run. The transitional character of these invisible penumbral eclipses is well illustrated by the case of the "farewell-eclipse" of January 5, 1935; a slight improvement in the elements used in the computations led to the prediction of a contact between the cone of the penumbra and the surface of the flattened earth;

TABLE I

INVISIBLE PENUMBRAL AND NON-CENTRAL UMBRAL ECLIPSES.

		Percentages of all solar eclipses	Percentages of eclipses by umbra	Percentages of eclipses within group
p	partial, visible	35.1	....	99.4
(p)	partial, invisible	0.2	.. .	0.6
		35.3		100
a	annular, central	32.0	49.5	98.2
(a)	annular, non-central	0.6	0.9	1.8
		32.6	50.4	100
at	annular-total	4.4	6.8	100
t	total, central	27.5	42.4	99.1
(t)	total, non-central	0.2	0.4	0.9
		27.7	42.8	100

[1] Denkschriften d. Akad., math.-naturw. Cl., Bd. 52, Wien 1887.

[2] A saros series, identical with the Saros-Zyklus of the Germans, is a series of eclipses occurring, under slowly changing circumstances, at intervals of 6585.32 days. The Greeks had a word—exeligmos—for a triple saros, *i.e.* for an interval of 19756 days.

TABLE II

ECLIPSES WITHOUT A NOON POINT OF CENTRALITY.

		Percentages of all				
		solar	umbral	annular	ann.-total	total
Sunrise ecl.:		1.8	2.7	.	.	.
	a & (a)	.	.	3.3	.	.
	at	.	.	.	0.3	.
	t & (t)	.	.	.	.	2.5
Sunset ecl.:		1.7	2.6	.	.	.
	a & (a)	.	.	3.1	.	.
	at	.	.	.	0.3	
	t & (t)	.	.	.	.	2.5
Midnight ecl.:		1.5	2.4	.	.	.
	a & (a)	.	.	2.7	.	.
	at	.	.	.	2.0	.
	t & (t)	.	.	.	.	2.0

on the other hand, a repetition of Oppolzer's computations, with an improved set of elements, could eliminate from the *Canon* some of the 18 eclipses listed as invisible, by showing that the cone of the moon's penumbra could not touch, on these occasions, even a spherical earth. The role played by the transitional *P″* eclipses of the saros series S124 and S1, in the Gregorian-calendar seven-eclipse years 1656 and 1935, respectively, will be discussed in a forthcoming paper.

In the case of about two per cent of the annular eclipses, and of about one per cent of the total eclipses, the axis of the oblique umbra fails to touch the surface of the earth; in the saros series, these non-central eclipses may occur at or near the beginning or the end of the runs of umbral eclipses; 85 per cent of these non-central eclipses are either sunrise or sunset eclipses; the remaining 15 per cent, consisting of a few eclipses of the midnight sun and of half a dozen "out-of-season" eclipses with noon points of centrality outside the polar circles, belong to the saros series S205, S58, S199, S123, S36, and S96, which will be dealt with elsewhere, in connection with exeligmos curves; the theoretically possible case of a non-central annular-total eclipse does not occur in the *Canon*. The transitional character of non-central eclipses by the umbra is illustrated by the fact that, in Oppolzer's original classification, they were considered as partial eclipses; Schram's designation, "nicht central," was introduced during the printing of the *Canon*, and the corresponding corrections were included in the list of errata, on page 377.

Eclipses which have no noon point of centrality constitute almost eight per cent of all the umbral eclipses; in the saros series, they may occur at the ends of umbral runs, forming a transition between partial and regular central eclipses. The important relation existing between these high-latitude, low-altitude eclipses, and the central eclipses which are separated from them by an interval of 595 years, will be discussed in connection with the exeligmos curves. Eclipses in high latitudes offer an opportunity to study the influence, on the saros series, of the length of the umbra and of the angle between the axis of the umbra and the axis of the earth, *i.e.* of the position of the node with respect

to the perihelion and aphelion, and to the solstitial and equinoctial points; these matters will be discussed elsewhere, and will be summarized in the paper devoted to the Antarctic midnight eclipse of December 25, 1935; for the purposes of the present paper, the following remarks, concerning the "seasonal fluctuations" of the number of eclipses without a noon point of centrality, will suffice; the fluctuations of the number of high-latitude eclipses in the course of the centuries will be dealt with in connection with the "birth and death rate" of saros series.

Sunrise eclipses occur, in high northern latitudes, between the winter and the summer solstices, and, in high southern latitudes, when the earth is in the other half of the ecliptic; about 75 per cent of the northern sunrise eclipses occur in the vernal-equinox arc, *i.e.* during the months of February, March, and April; about 70 per cent of the southern sunrise eclipses occur in the autumnal-equinox arc, *i.e.* in August, September, and October; 52 per cent of all the sunrise eclipses of the *Canon* belong to the southern hemisphere.

Sunset eclipses are possible, in high northern latitudes, between the summer and the winter solstices, and, in high southern latitudes, during the other half of the year; almost 80 per cent of the northern sunset eclipses belong to the months of August, September, and October; about 75 per cent of the southern sunset eclipses occur in February, March, and April; 56 per cent of the sunset eclipses of the *Canon* belong to the southern hemisphere.

Eclipses of the midnight sun occur, in the Arctic, between the vernal and the autumnal equinoxes, and, in the Antarctic, when the sun is south of the equator and the earth is in the perihelion arc; about 75 per cent of the Arctic midnight eclipses occur during the months of May, June, and July; about 90 per cent of the eclipses of the midnight sun in the Antarctic occur in November, December, and January, the month of December alone accounting for about 45 per cent of all the eclipses of the Antarctic midnight sun; 55 per cent of all the midnight eclipses of the *Canon* belong to the southern hemisphere.

Oppolzer's 8000 eclipses cover more than thirty-three centuries, from 1208 B.C. to A.D. 2161. They belong to 152 saros series, 64 of which are complete within the limits of the *Canon*. The 88 truncated solar saros series include, on the one hand, the initial dates P' of S61 and S155, respectively, and, on the other hand, such series as S17, S23, S13, or S101, the runs of which are almost complete within the limits of the *Canon*. The present paper deals, of course, both with the 64 complete and with the 88 truncated solar series; in other words, it is based on a study of

101 runs (p') of initial penumbral eclipses
81 runs (u) of umbral "
101 runs (p'') of terminal penumbral "

of the sun, and of

107 dates (P') of first penumbral eclipses
109 dates (U') of first umbral "
110 dates (U'') of last umbral "
109 dates (P'') of last penumbral "

of solar saros series.

In the case of truncated series, an umbral run is considered as complete, if the *Canon* includes both the last partial eclipse preceding the date U' and the first partial eclipse following the date U''; in order to insure the actual completeness of the 202 penumbral runs, "safety margins" of eighteen years were left at the beginning and at the end of the *Canon;* thus, umbral runs like those belonging to the series S58 or S113, were considered as truncated, and the 64 complete series do not include series like S17 or S23. Some of the truncated series, at the beginning of the *Canon,* are important for the history of Old-World astronomy and chronology; the role of the exeligmos loops of such series as S5 or S52, in the conception and development of the idea of the saros and of the exeligmos, will be discussed elsewhere. Of the 64 complete solar saros series included in Oppolzer's "book of numbers," 56 belong to the minor, and 8 to the major type; of the 56 minor series, 29 are pure and 27 are hybrid; the relative frequency of the minor and major solar saros series will be dealt with in connection with a study of the number of lunar and solar saros series running simultaneously.

The first, simplest, and rather superficial characteristic feature of the minor and major types of solar saros series is their duration, or the number n of eclipses they contain; see Table III. This table is based

TABLE III

VALUES OF p', u, p'', AND n.

		——Short runs——			——Long runs——		
		min.	max.	usual	min.	max.	mean
Umbral runs,	u	39	48	43, 41	51	59	55
Penumbral runs, .	p' or p''	6	14	7, 8	16	25	21
Solar saros series, $p'+u+p''=n$		70	76	72, 71	79	85	83

on the 81 umbral runs, the 101 initial and the 101 terminal penumbral runs, and on the 64 values of n. Two out of three minor solar series consist of 72 or 71 eclipses; there are about 83 eclipses in a major series. The duration of a minor series varies from 1244 to 1352 years, while a major series may run from 1406 to 1514 years. The frequent occurrence of minor series lasting 1262 or 1280 years, combined with their regular distribution, is contributing to the periodicity of the numbers of saros series running simultaneously. Due to the peculiar frequency distribution of the lengths of short runs, Table III gives their most frequent values, instead of averages. About 65 per cent of the short runs of penumbral eclipses consist of 7 or 8 eclipses each; their duration is, therefore, 108 or 126 years; the average duration of a long run of penumbral solar eclipses is 361 years. One half of the short runs of umbral eclipses consist of 43 or 41 eclipses; their duration is, therefore, 757 or 721 years; the average duration of a long run of umbral eclipses is 973 years.

A glance at the diagram reproduced in Figure 1 shows the second characteristic feature of the minor and major types of solar saros series—their composition, or, the relative length of the p', u, and p'' runs; see Table IV. In a pure minor series, the run of umbral eclipses,

TABLE IV

COMPOSITION OF TYPICAL SOLAR SAROS SERIES.

Series	Minor (pure) S12	Hybrid (minor) S136	Major S176
$p'+u+p''=n$	7+55+9=71	21+43+8=72	19+41+23=83
u/n	0.8	0.6	0.5
$(p'+p'')/n$	0.2	0.4	0.5

u, is long, while both penumbral runs are short; in a hybrid minor series, the umbral run, u, is short, and one of the penumbral runs, either p' or p'', is long; in a major series, the umbral run is short and both penumbral runs are long; there are no hybrids among the major solar series. Hybrid minor series are about as frequent as pure minor series; they are, in many respects, closely related to the major type; solar saros series could, therefore, be classified as minor, hybrid, and major series. In the case of investigations dealing with the duration rather than with the nature of the saros series, it is more convenient to distinguish between the pure and hybrid minor series, on the one hand, and the major series on the other. In the case of studies based on the shape of the exeligmos curves, or, more generally, on the composition rather than on the length of the saros series, it is advantageous to consider the hybrids as a separate group, closely related to the major type. A glance at the Tables IV, V, and VI reveals the role of the hybrids as a link between the pure minor and the major series.

TABLE V

SEASONAL DISTRIBUTION OF THE DATES P', U', U'', AND P'' OF THE 64 COMPLETE SOLAR SAROS SERIES.

	P'			U'			U''			P''		
	m	h	M	m	h	M	m	h	M	m	h	M
Jan.		2			1		1					2
Feb.		4			5		5					2
Mar.		4			4		5				1	4
Apr.	6	2			4	3	9				7	
May	11				5	5	8	4		7	4	
June	10	2		3	7			11		9		
July	2	8		7	1			2	6	9	1	
Aug.		5	3	9				5	2	4	4	
Sept.			2	5				4			5	
Oct.			3	5				1			5	
Nov.												
Dec.							1					

The third—and most essential—characteristic feature of the minor and major types is the seasonal distribution of the runs of umbral and penumbral eclipses, *i.e.* the location, on the ecliptic, of the dates P', U', U'', and P''; the results derived from the 64 complete series are given in Table V. Additional tables—not reproduced here—were compiled, showing the correlation between the length, u, and the extreme dates,

U' and U'', of the 81 complete umbral runs, as well as correlations between the lengths and opening and closing months of the complete runs of initial and terminal penumbral eclipses; these additional tables confirmed the usefulness of Table V for the determination of the type or of the approximate duration of truncated series; a more detailed discussion of these matters will be included in a study of the exeligmos curves of solar eclipses.

The diagram reproduced in Figure 1 was obtained by plotting the points P', U', U'', and P'' as abscissae, and the lunations of the corresponding saros series as ordinates; this diagram could be transformed into a three-dimensional one, by mounting it on a cylinder in such a manner that the saros series S223 (bottom, center) should coincide with the imaginary line joining the zero-lunation points of the scales of ordinates (top). The cylindrical diagram may, moreover, be considered as formed in the following manner: the 8000 consecutive solar eclipses of the *Canon* are plotted on a narrow tape, and the tape is wound, in a spiral having a pitch corresponding to 6585.32 days, around a cylinder having an appropriate diameter; there will be 187 windings, and the eclipses plotted on the tape will form, on the cylinder, the pattern reproduced in the diagram of Figure 1. In this diagram, the dates P' and P'' are indicated by circles, the dates U' and U'', by dots, and the runs of umbral eclipses are emphasized by heavy lines.

The short quasi-vertical lines which are separated by intervals of $2 \times 586 = 1172$ years or 65 saroses, and which form, in the direction of the ordinates, a 65-year and double-Mec[3] pattern, will be explained in a forthcoming paper. The additional horizontal lines, in the upper half of the diagram, represent saros series of lunar eclipses; a "close-up" view of lunar saros series was given, in the eclipse paper which appeared in the April issue of POPULAR ASTRONOMY, in the diagram of Figure 1. A lunar saros series, Ln, begins when the eclipses of the immediately preceding solar saros series, Sn, are in the second half of their umbral run; it ends, before the eclipses of the immediately following solar saros series, S(n+1), have reached the immediate neighborhood of the node. The run of total lunar eclipses of the series Ln overlaps not only with the terminal penumbral run of Sn and with the initial penumbral run of S(n+1), but also with the end of the umbral run of the former and with the beginning of the umbral run of the latter. This overlapping produces the correspondence between the long runs of total lunar and long runs of penumbral solar eclipses, on the one hand, and between the short runs of total lunar and short runs of penumbral solar eclipses, on the other. These and related matters will be discussed elsewhere, in connection with lunar appulses, with the periodicity of certain groups of eclipses, etc.

A discussion of the influence, on the shape of the exeligmos curves, of the relative positions of the earth and of the moon in their respective

[3] The Maya eclipse cycle (Mec) corresponds to 11960 days.

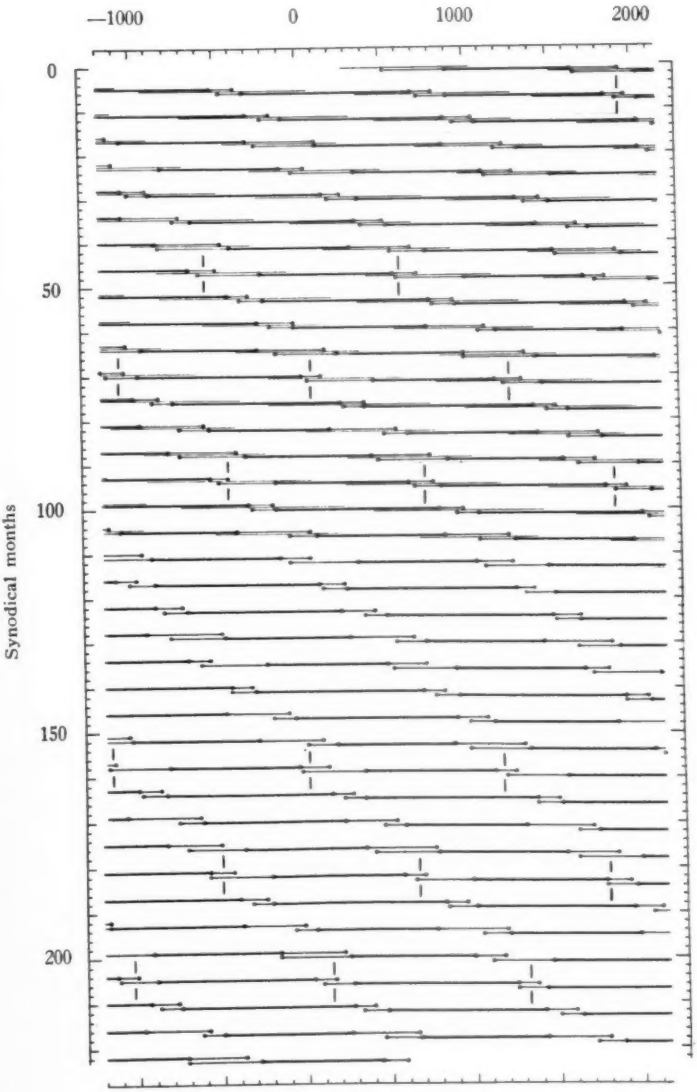


FIGURE 1.

CYLINDRICAL DIAGRAM OF SOLAR SAROS SERIES
1208 B. C. TO A. D. 2161.

orbits, will be found elsewhere; some of the resulting sequences of solar saros series are indicated in Table VI, and will be briefly summarized

TABLE VI

EXELIGMOS SEQUENCES.

Ascending node						Descending node					
X′		Y′		Z′		X″		Y″		Z″	
222-1	M	106	h	211-213	m	216-218	h	111-113	h	6	m
24	h	129	M	11-13	m	193-195	h	88	M	206	m
47	h	152-154	M	36	m	170-172	h	65	M	181-183	h
70-72	m	175-177	M	59	h	147	m	42	h	158-160	h
93-95	m	200	h	82-84	h	122-124	m	17-19	h	135	h
118	m	223	h	105-107	h	99-101	m	217-219	h	112	h
141	m	23-25	h	130	h	76-78	m	194	h	89	h
164-166	m	46-48	h	153	h	53	m	169-171	h	64-66	M
187-189	m	71	h	176-178	M	28-30	m	146-148	h	41-43	M
212	m	94	h	199-201	M	5-7	m	123-125	m	18	M
12	m	117-119	m	222-1	M	205-207	m	100	m	216-218	h
35-37	m	140-142	m			182	h	77	m		
58-60	m, h	163-165	m			159	h	52-54	m		
81-83	h	188	m			134-136	h	29-31	m		

in the present paper; these sequences are based on the following periods, corresponding to a gradual transition from one exeligmos curve to a similar one:

$$\begin{aligned} \mathrm{Sn} &\rightarrow \mathrm{S}(n \pm 2) \quad \ldots\ldots\ldots \quad 4 \times 586 = 2344 \text{ years,} \\ \mathrm{Sn} &\rightarrow \mathrm{S}(n \pm 23) \quad \ldots\ldots\ldots \quad 586 - 65 = 521 \text{ years,} \\ \mathrm{Sn} &\rightarrow \mathrm{S}(n \pm 105) \quad \ldots\ldots\ldots 586 + 5 \times 65 = 911 \text{ years.} \end{aligned}$$

Let us begin with the 521-year period, and consider, on the cylindrical diagram of Figure 1, the descending-spiral group S1, S24, S47, S70, and S93; these ascending-node saros series, separated, on the diagram, by steps of 23 lunations, are characterized by a gradual change of the shape of their exeligmos curves, corresponding to the return, at intervals of 521 years, of similar eclipse conditions. This interval of 521 years may be considered as a "hyper saros," since it plays, in the formation of sequences of saros series belonging to the same node, a role similar to the one played by the 18-year interval in the formation of separate saros series. The 2344-year period permits us to pass to the next descending-spiral sequence, either from S70 to S72, or from S93 to S95; we continue along the descending spiral II′, by steps of 23 lunations, until we reach S164 and S187, where we pass to the descending-spiral sequence III′, and so on, until we arrive, after four revolutions of our cylindrical diagram, at the series S222 which belongs to the descending-spiral sequence IX′, and whose exeligmos curves are linked, by the 2344-year correspondence, to the exeligmos curves both of the series S1 which ended on January 5, 1935, and of the prehistoric series S220. It should be kept in mind that the ascending-node sequence X′Y′Z′ of Table VI consists of 9 fragments belonging to 9 different descending-spiral sequences; on the cylindrical diagram, the descending

spirals are arranged as follows:

I′-VIII′-VI′-IV′-II′-IX′-VII′-V′-III′-I′.

The bridging couples, Sn and S(n+2), used by us for connecting a descending-spiral sequence with the next one, belong to 19 double-strand longitudinal-spiral sequences of ascending-node saros series; due to the generally slow changes in the shape of the exeligmos curves of the longitudinal-spiral 2344-year sequences, the composite X′Y′Z′ sequence gives us a satisfactory idea of the character of the 9 descending-spiral 521-year sequences; there is a certain analogy between the composite X′Y′Z′ sequence of Table VI and a natural-history museum exhibit illustrating an evolutionary sequence by the juxtaposition of examples of successive stages of development through which several specimens had to pass in the natural course of events. By combining, in a similar manner, the segments of the 9 ascending-spiral 521-year sequences of descending-node saros series, the composite sequence X″Y″Z″ was formed; on the cylindrical diagram, the 9 ascending spirals alternate with the 9 descending spirals, and form a pattern symmetrical with respect to the intervals between the spirals I′ and I″, and II′ and II″.

The sequences X′Y′Z′ and X″Y″Z″ of Table VI show the role of the hybrids in the cyclical transition from pure minor to major and back to minor saros series. The evolution of the vernal arcs of the ascending-node loops and the evolution of the winter cusps of the X′Y′Z′ exeligmos sequence has a counterpart in the evolution of the autumnal arcs of the descending-node loops and the evolution of the winter cusps of the X″Y″Z″ exeligmos sequence.

In order to bring out an important feature of these "hyper-saros" sequences, one of the secondary periods has been used to break the ascending-node composite sequence X′Y′Z′ into the "hyper-exeligmos" sequences X′, Y′, and Z′, and the descending-node composite sequence X″Y″Z″ into X″, Y″, and Z″, as shown in Table VI. The corresponding saros series of the columns X′, Y′, and Z′, separated by 105 lunations on the cylindrical diagram, are characterized by exeligmos curves which are similar in shape and show a northward displacement of the loops and cusps, with a period of 911 years; the displacement of the loops and cusps remains northward, from column to column, in the case of the descending-node exeligmos curves arranged in the order indicated by the columns X″, Y″, and Z″ of Table VI. There is a certain analogy between the role played by the 911-year period in breaking a 521-year sequence of saros series into three similar but systematically shifted sequences of exeligmos curves, and the role played by the 54-year period in combining, into three similar but systematically shifted exeligmos curves, the eclipses belonging to a saros series.

The corresponding exeligmos curves of the columns X′ and X″, Y′ and Y″, and Z′ and Z″, are mirror images with respect to the North-South direction, the ascending-node curves being concave toward the West, and the descending-node curves concave toward the East. In

order to locate, on the cylindrical diagram of Figure 1, a descending-node saros series which contains mirror images of the exeligmos curves of a given ascending-node saros series, it should be kept in mind that one longitudinal-spiral axis of symmetry passes through the middle of the diagram, between S107 and S112, while the other axis is located both at the bottom and at the top of the diagram, between S218 and S1. The distribution of the ascending-node and of the descending-node major saros series, with respect to these two longitudinal-spiral axes, will be dealt with in the paper on exeligmos curves.

The cylindrical diagram represents less than thirty-four centuries of eclipses—a brief moment in the history of the solar system; nevertheless, the *Canon* permits us to get a glimpse of the patterns formed by groups of eclipses separated by certain intervals which have a chronological value. Some of the problems considered in the forthcoming papers are somewhat analogous to the problem of reconstructing the geometrical pattern of a rug, of which a very narrow diagonal strip has been preserved, running from corner to corner, and containing short pieces of all the warp and weft threads.

I wish to express my thanks to Miss V. Peterson, of the Yerkes Observatory staff, for her share in the computations woven into the cylindrical diagram of Figure 1.

CARNEGIE INSTITUTION,
WASHINGTON, D. C.
FEBRUARY 26, 1935.

The Selection and Prediction of Occultations for any Place and Time

By ISABEL M. LEWIS

(Continued from page 290.)

The case will now be considered in which the elements of occultation are not known in advance and it is desired to select from a prepared list of occulted stars for the beginning of the year, or from star catalogues, bringing the star's position up to the beginning of the year, a number of stars that will be occulted during a stated interval of time at the place for which the chart has been constructed.

It is assumed that an interval will be chosen during which the sun is below the horizon and the moon above the horizon at the place. This can be determined by reference to tables of sunrise and sunset and moonrise and moonset, if it is not already known in advance. The Standard Time at the beginning and ending of the interval chosen is first to be changed to the corresponding Greenwich Civil Time and then for every hour of Greenwich Civil Time in the interval the right ascension and declination of the moon and their hourly differences are to be

copied from the *American Ephemeris,* or any other suitable source. The hourly differences for each hour are found simply by taking the mean of the first differences, in this case. Take out from the *Ephemeris,* also, the parallax of the moon for each hour. As it is tabulated for every twelve hours it will be necessary to interpolate it to every hour. It is quite sufficient for approximate predictions to write down the parallax to the nearest whole second of arc. The hour angle of the moon for each hour is also needed, and it will be found convenient to take it from the *American Nautical Almanac* where it is tabulated in arc for every hour of the year. It should be changed to time by means of a table for converting arc into time. The longitude of the place of observation is now to be subtracted from H to give H-λ for each hour. This is the local hour angle of moon and star for geocentric conjunctions that occur exactly at the tabulated hours. When the time of conjunction of the moon and star falls between any two hours interpolate H-λ to that time. The time of geocentric conjunction of the moon and a star in right ascension, T, when it occurs, between the tabulated times is found by subtracting the right ascension of the moon tabulated for the next preceding hour from that of the star and then dividing the difference by the hourly motion of the moon in right ascension. This will give the decimal of an hour counted from the preceding hour of Greenwich Civil Time, at which the conjunction of star and moon will occur. This T is one of our required elements and gives the time when the moon is on the Y-axis, and H-λ, interpolated to this time, gives the corresponding local hour angle of the moon, as well as the time point of the place on the ellipse, corresponding to the star's declination. We next multiply the decimal of an hour just obtained by the hourly motion of the moon in declination and apply the result to the tabulated declination of the moon for the preceding hour to obtain the declination of the moon at the time of conjunction T. The element Y can now be taken from the appropriate table with arguments the parallax of the moon and $\delta_m - \delta_s$, obtained by subtracting the declination of the star from that of the moon.

The elements x′ and y′ are now taken from the tables with argument the parallax of the moon and the values of $\Delta\alpha$ and $\Delta\delta$, the hourly motions in right ascension and declination, respectively. They, as well as Y, are needed only to three decimal places and it will generally be found to be sufficient to take them from the tables for a time near the middle of the interval of observation. We are now prepared to examine as many stars as we desire in this interval.

In the selection of stars to be occulted in this interval of observation, the elements Y and H-λ need be found only approximately, and the reader will find for himself many short cuts in practice. When it is evident that a good occultation of a star coming within the interval has been found, the elements may be interpolated with more care, and if a close prediction is desired the correction from mean to apparent place applied and the value of T and Y obtained more closely. This will never be

necessary if an uncertainty of two, or three, minutes is allowable in the prediction of the times.

A first selection of stars to be tested is made from the prepared mean place list for the beginning of the year of occulted stars or from star catalogues. The same star is often occulted several times a year, and a list of mean places of 300 stars will yield nearly two thousand occultations a year for the earth generally, though scarcely 100 at any one place.

It is an advantage to all observers of occultations in all parts of the world to have access to such a list of mean places of occulted stars for the beginning of the year. A list of nearly 300 faint stars occulted in 1936 is published in the *American Ephemeris* for the year 1936.

The stars to be examined in our chosen interval will be those that have right ascensions falling between the values of the right ascension of the moon for the first and last hour of the period, and with declinations falling within a degree and a half, at the most, of the moon's declination at the time when the right ascensions of stars and moon are equal. As the limit is wide, some stars included will be rejected as soon as Y is taken from the table. This element furnished a valuable test for visibility of an occultation at the given place. The reader will soon note this for himself in the application of the method. It is of far more value than the limiting parallels which are of little practical use in the selection of occultations. For example, in latitude 42° 30′ North, stars for which Y is negative are never occulted, except in a few exceptional cases when the star has a northern declination greater than 25°. Then a few stars may experience grazing occultations when Y has a small negative value. Since $Y \times \pi_m = \delta_m - \delta_s$ it can be shown that in this latitude stars whose declinations lie north of the moon at time of conjunction by more than a few minutes of arc can never be occulted, and *vice versa* in the southern hemisphere. These facts the reader will soon learn for himself, and it greatly facilitates the selection of stars to be occulted and narrows in one direction the adopted limit of $1\frac{1}{2}$ degrees which we have set.

After the stars have been selected that have right ascensions and declinations falling within the limits set, the values of T, Y, and H-λ are found for each star as explained above; x' and y' are already known for the interval and the reduction from mean to apparent place can be applied, if a close prediction is desired, though it is hardly necessary if the time of immersion is required only within one or two minutes.

The procedure from this point is the same as it is when the elements are known in advance. In general, only the immersion at the dark limb is observed and the observer is not interested in the time of emersion though it is obtained in the same way with the exception that in this case it is the time of contact of the following limb of the moon with the place on the ellipse that is to be found.

It might be mentioned here that by varying the longitude, λ, and, therefore, H-λ, and keeping x', y', and Y constant, one can determine

within what limits of longitude the occultation of any particular star will be observable along the same parallel of latitude passing through the place of observation.

An example will now be given of the use of this method in a particular case.

Let it be assumed that the place of observation is in latitude 42° 30′ North, as this is the latitude for which we have constructed the chart, (see Fig. 1, p. 283), and that the longitude is $4^h\ 50^m$ west of Greenwich and the time chosen for observation of occultations is between 7:00 P.M. and 11:00 P.M., E.S.T., on February 10, 1935. The corresponding Greenwich Civil Time will be February 11, 0^h to 4^h.

The following data are obtained from the *American Ephemeris* for 1935, pages 44 and 127:

G.C.T. Feb. 11	α_m	$\Delta\alpha$	δ_m	$\Delta\delta$	π_m
h m	h m s	s	° ′ ″	″	′ ″
0 0	3 40 59.4	138.5	24 24 49.2	358.7	56 29
1 0	43 17.9	138.5	24 30 43.8	349.6	56 27
2 0	45 36.5	138.6	24 36 28.2	341.3	56 25
3 0	47 55.1	138.6	24 42 5.3	332.9	56 23
4 0	50 13.8	138.7	24 47 34.0	324.6	56 21

The third and fifth columns are obtained by taking the mean of the first differences preceding and following the function and they are the hourly motions in right ascension and declination, respectively, and with H-λ are the arguments for obtaining x′ and y′.

Tabulate also the following quantities:

G.C.T.	H	H-λ	x′	y′
h m	h m	h m		
0 0	5 39.5	0 49.5	0.558	0.105
1 0	6 37.4	1 47.4	.558	.103
2 0	7 35.2	2 45.2	.558	.101
3 0	8 33.1	3 43.1	.558	.098
4 0	9 30.9	4 40.9	.559	.096

H, the hour angle of the moon can be taken from the *American Nautical Almanac,* where it is given for every hour of the year, and converted into time. It may also be obtained by adding to the sidereal time of 0^h, G.C.T., the sidereal equivalent of each of the above hours in turn (see page 2 and Tab. III, *A.E.*, 1935) and subtracting from the sum the tabulated right ascension of the moon for the corresponding hour.

The values of x′ and y′ are taken from tables published separately.* The four stars whose positions for the beginning of the year are given below will now be tested for occultation at this place during the given interval of time.

*It was not feasible to print the tables with the paper. The tables will, however, be included with the reprints.

These stars to be examined with their approximate positions for 1935 are:

	α_s	δ_s
	h m s	° ′ ″
17 Tauri	3 41 0.7	23 54 37
22 Tauri	42 10.3	24 19 36
23 Tauri	42 27.8	23 44 50
η Tauri	43 37.0	23 54 20

They are taken from the *A. E.* for 1935 that we may compare the elements and results obtained with those published on pages 599 and 638. It will be found that the use of the mean place of the stars for the beginning of the year instead of the apparent place at date introduces an error here in the times of immersion of about one-half of a minute.

The time of geocentric conjunction of each star with the moon is now obtained as explained above and the values of H-λ and the declination of the moon are then interpolated to this time, which is the element T. The value of $\delta_m - \delta_s$ is then obtained by subtracting the star's declination from the interpolated declination of the moon. Y is then taken from the tables with the value of $\delta_m - \delta_s$ and π_m for arguments. These quantities tabulated for the four stars are as follows:

	T	H-λ	$\delta_m - \delta_s$	Y	Ellipse
	h	h m	′ ″		°
17 Tauri	0.009	0 50	30 15	+0.535	+24
22 Tauri	0.511	1 19	8 15	.145	24
23 Tauri	0.638	1 26	43 45	.774	24
η Tauri	1.138	1 55	37 11	.658	24

T should be changed to minutes by multiplying by 60. It was needed in decimals of an hour for interpolating the moon's declination to the time T.

The elements for testing these stars for occultation are now at hand, namely x′, y′, which may be taken constant for the whole interval, Y, T, and H-λ, as well as the declination of the ellipse to be used for each star, which is the same as the declination of the star being tested required only to the nearest whole degree. This is given above in the last column.

Upon setting the center of the transparent lunar strip, with its inscribed disk, at the value of Y = +.535, (5.35 cm) on the chart, Fig. 1, and giving the path the slope determined by the values of x′ and y′ which are 0.558 and +0.105 respectively (5.58 and 1.05 cm) it is noted that the star, 17 Tauri, for which H-λ is $0^h\ 50^m$ is to be occulted about one minute before the center of the moon reaches the Y-axis. This is evident from the fact that the place which is on the ellipse, +24°, has the hour angle $0^h\ 50^m$ and so is at the time point $0^h\ 50^m$, on the ellipse when the moon is on the Y-axis and is then just within the radius of the moon. If the moon's center is moved backward about 1 mm, which is approximately its motion along its path in one minute of time, its limb will be in contact with the place on the ellipse, which has remained practically unchanged in position in that short interval. This correction of minus one minute added to T, the time when the moon is on the

Y-axis which is $0^h\ 0^m.5$, gives the approximate time of immersion for this star as February 10 $23^h\ 59^m.5$, G.C.T., or February 10, 6:59.5 P.M., E.S.T.

As the slope of the path remains practically constant during the interval of observation it will be an advantage to place a ruler along the line connecting the extremities of the measured distances, x′ and y′, having it far enough below the Y-axis so as not to interfere with the lunar strip and, leaving it in this position, place the strip parallel to this ruler as each star is tested. This obviates the necessity of resetting the direction of the path for each star. The variable elements for each star during this interval are, T, Y, and H-λ, the same ellipse, 24 being used for all four stars.

The star, 22 Tauri, with elements $Y = +0.145$ (1.45 cm) and $H\text{-}\lambda = 1^h\ 19^m$, will also be occulted. The place is at the time point $1^h\ 19^m$ when the moon is on the Y-axis so it must be overtaken by the moon east of the axis. The hour angle of the moon at the time its eastern limb is in contact with the place will be $1^h\ 19^m$ plus the motion in hour angle in a mean time interval, t. The hour angle of the place at that time must have the same value as that of the moon's center. It is evident that by moving the moon's center forward about 7mm, which represents its motion in a little less than 7 minutes, the corrected hour angle of the place and the moon's center will be the same, about $1^h\ 26^m$, and adding 7 minutes to T, which is $0^h\ 30^m.7$, the time of immersion comes out approximately February 11 $0^h\ 38^m$, G.C.T., or February 10, 7:38, E.S.T.

The position angles of immersion from the north point of the lunar disk come out about 140° and 50°, respectively, for these two stars.

It is evident at once upon inspection of the elements of the two remaining stars that they cannot possibly be occulted. The values of Y when plotted put the path of the moon too far north for the ellipses on which they lie to get within radius of the moon before it passes below the horizon.

This method is of particular value in the case of these two stars, which are typical of a large number; for referring to page 805 of the *American Ephemeris* for 1935, in connection with page 599, it is evident that both of these stars fulfill the three tests applied for visibility of an occultation at this place, and it would be expected that an occultation of both of them would occur. As a matter of fact, impossible results would be obtained by the analytical method after carrying the computation through to a certain point, entailing considerable unnecessary work.

It is possible by the application of this method to reject such stars almost upon inspection as soon as the elements are known. In some instances, x′, y′, and Y are all that are needed to show the impossibility of occultation of some stars. It will be found that practice and familiarity with the chart will enable one to reject or keep certain stars very rapidly.

If one has access to a calculating machine, or *Crelle's Rechentafeln*, the values of x′, y′, and Y can be computed with the aid of the following

formulae nearly as rapidly, to three decimal places as they can be taken from the tables.

These formulae are:

$$x' = \cos \delta_m \, \Delta\alpha_m / \pi_m$$
$$y' = \Delta\delta_m / \pi_m$$
$$Y = (\delta_m - \delta_s) / \pi_m$$

where $\Delta\alpha_m$, $\Delta\delta_m$, and π_m are tabulated above for every hour of the interval, and δ_m and $\delta_m - \delta_s$ are found for each star after the time of conjunction has been obtained.

To construct the chart for any place will take only a few hours and once constructed it may be used repeatedly at that place as no lines or figures need be put upon it.

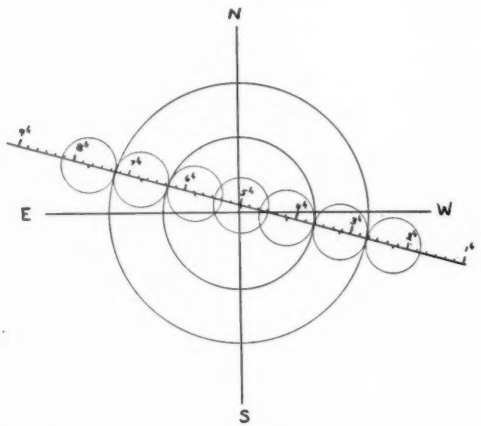
This method will also be found useful for checking predictions made analytically or otherwise.

1921 Park Road, N. W., Washington, D. C.

Total Eclipse of the Moon July 16, 1935

By RALPH C. LOWE

The accompanying illustration is a graphic representation of the passage of the moon through the umbra and penumbra of the earth which will occur on July 16, 1935.



The method followed in the computation is that described by Professor Rigge in his book on Eclipses and Occultations.

The large circles represent the umbra and penumbra of the earth. The graduated line represents the moon's path, graduated in hours of Greenwich Civil Time. The small circles show the moon at its various phases

of entering and leaving the umbra and penumbra; also its position at mid-eclipse.

The moon is only slightly to the north of the center of the umbra and penumbra, and therefore the intensity of illumination of its disc should be quite small. The relative intensity of this illumination in any total eclipse will depend on the density of the clouds over that part of the earth's surface where the sun's rays pass before being refracted into the umbral cone. If there are sufficient clouds, the moon may be completely obscured from view near mid-totality.

The moon is in south declination and therefore is not best situated for northern observers, however, the total phase should be well seen throughout the United States.

In the vicinity of Philadelphia the moon will be a very few minutes to the west of the meridian, and will be elevated about twenty-eight degrees above the horizon at mid-totality.

The times of these phases expressed in G.C.T. are as follows:

	h m		h m
Moon enters penumbra	2 14	Total eclipse ends	5 49
Moon enters umbra	3 12	Moon leaves umbra	6 46
Total eclipse begins	4 09	Moon leaves penumbra	7 43
Middle of eclipse	4 59		

MEDIA, PENNSLYVANIA.

An Astrolabe of Today

By ARTEMUS B. HENNINGSEN

Of the instruments used in medieval learning one of the most fascinating and most scientific was the planispheric astrolabe. It is to the locations of heavenly bodies as the slide rule is to the logarithms of numbers. A modern homemade astrolabe constructed by the author is shown in the accompanying illustration.

The instrument weighs a little over a pound, and the mater is five and one-half inches in diameter. The table is khumsi or quinquepartite. The rete contains ten star pointers: Rigel, Sirius, Regulus, Aldebaran, Spica, Antares, Arcturus, Vega, Al Deneb, and Altair. The projection is stereographic.

The ring, pin, and rivets are of brass rod. The mater, rete, label, rule, and sights, and the horse were cut from a plate of one-sixteenth inch brass so that the assembled mater is one-eighth inch thick and very sturdy. The border is held to the rest of the mater by three rivets. The border and rete were originally concentric in the same piece of brass and were separated on a lathe. The rete was cut out by drilling and filing as well as by saw-piercing. The turning, drilling, and riveting were done at machine shops. The sights were brazed to the rule by a manufacturing jeweler.

The engraving was all done by hand by the present author. Some of

the engraving is wriggled, some is lined, some is bright-cut, and much is in script. The engraving was done without the aid of an eyepiece. (Incidentally brass is a very hard metal to engrave; copper could have

AN ASTROLABE CONSTRUCTED BY ARTEMUS B. HENNINGSEN.

been engraved more easily, but would have been less handsome.) The construction of this instrument for the solution of spherical triangles required many, many hours of spare time.

BIBLIOGRAPHY

Jenkin, C. F.—"The Astrolabe, Its Construction and Use." Oxford, 1925.
Gunther, R. T.—"Early Science in Oxford, Vol. V. Chaucer and Messahalla on the Astrolabe." Oxford, 1929.
Skeat, Walter W.—"The Student's Chaucer." Oxford, 1929, (pg. 396: A Treatise on the Astrolabe).

CLINTON, IOWA.

Planet Notes for July and August, 1935

By CLIFFORD E. SMITH

NOTE: All times are Central Standard Time unless otherwise stated.

The *Sun* will be moving with a southeasterly motion from western Gemini, across Cancer, to central Leo. On July 3 at 8:00 P.M., the earth will be at aphelion: that is, the earth will be at the place in its orbit farthest from the sun. On July 30 there will be a small partial eclipse of the sun visible in the Indian Ocean and south polar regions. The position of the sun on July 1, and on the first and last days of August will be, respectively: R.A. $6^h\,36^m$, Decl. $+23°\,12'$; R.A. $8^h\,41^m$, Decl. $+18°\,19'$; and R.A. $10^h\,34^m$, Decl. $+9°\,4'$. The distance from the earth to the sun will be about 94.4 million miles at the beginning of July, and the distance will decrease to about 93.8 million miles by the end of August.

The phenomena of the *Moon* will occur as follows:

First Quarter	July	8 at	4 P.M.
Full Moon		15 "	11 P.M.
Last Quarter		22 "	2 P.M.
New Moon		30 "	4 A.M.
First Quarter	Aug.	7 "	7 A.M.
Full Moon		14 "	7 A.M.
Last Quarter		20 "	9 P.M.
New Moon		28 "	7 P.M.
Apogee	July	5 "	9 P.M.
"	Aug.	2 "	12 M.
Perigee	July	17 "	9 P.M.
"	Aug.	15 "	2 A.M.

On July 16 there will be a total eclipse of the moon,* "visible throughout the most of North and South America; the beginning generally in Africa, except the extreme northeastern part, southwestern Europe, the Atlantic Ocean, North America, except the northwestern part, South America, and the eastern part of the Pacific Ocean; the ending visible generally in the Atlantic Ocean, North America, except the extreme northern part, South America, and the eastern part of the Pacific Ocean."

Mercury will be moving with an apparent easterly motion from the extreme western part of Gemini, across Cancer, to eastern Leo. During July it will be a morning star, and during the middle of the month it will rise about an hour and a half before the sun. Superior conjunction will occur on August 9 at 7:00 P.M., and thus, during the latter part of August, Mercury will be an evening star. At the end of August Mercury will set about an hour after the sun. The distance from Mercury to the earth will increase from about 58 to about 118 million miles; the corresponding change in apparent diameter will be from about 11 to about 5

*POPULAR ASTRONOMY, January, 1935, p. 22, also p. 350 of this issue.

seconds of arc, respectively. Greatest elongation west will occur at 2:00 A.M. on July 14 (20°.8). At noon on August 26, Mercury will be in conjunction with Venus (Mercury 9°.0 N). Conjunction with the moon will occur on July 28 at midnight (Mercury 36′ N), and on August 30 at 4:00 P.M. (Mercury 5°.5 N). The position of Mercury on July 15 and on August 31 will be, respectively: R.A. $6^h\,4^m$, Decl. +20° 53′; and R.A. $11^h\,41^m$, Decl. +2° 55′.

Venus will be an evening star in Leo. At the beginning of this period it will set about three hours after the sun, but it will approach the sun rapidly in apparent position, and, at the end of the period, it will be only some seven or eight degrees from the sun. Venus will be approaching the earth during this period. Its distance will decrease from about 65 to about 28 million miles, and the corresponding change in apparent diameter will be from 24 to about 57 seconds of arc. At midnight on July 24 Venus will be in conjunction with Neptune (Venus 2°.6 S). Venus will be at its greatest brilliancy during this elongation on August 2 at 10:00 P.M., at which time its brightness will be about magnitude —4.2. Conjunction with the moon will occur on July 4 at 6:00 P.M. (Venus 4°.4 N), on August 2 at 7:00 P.M. (Venus 1°.7 N), and on August 29 at 1:00 P.M. (Venus 4°.0 S).

Mars will be moving with an apparent southeasterly motion from the central part of Virgo to the central part of Libra. On July 16 at 2:00 P.M. it will be at quadrature east, and thus, during the middle of July it will be toward the south at about 6:00 P.M., local civil time. Its distance from the earth will increase from about 93 to about 130 million miles, and its apparent diameter will decrease from about 9 to about 7 seconds of arc. On August 27 at 5:00 P.M. Mars will be in conjunction with Jupiter (Mars 2°.2 S). Conjunction with the moon will occur on July 9 at 4:00 A.M. (Mars 5°.1 N), and on August 6 at 4:00 P.M. (Mars 4°.3 N).

Jupiter will be an evening object in central Libra. Quadrature east will occur on August 7 at 6:00 P.M. Thus during the middle of this period Jupiter will be toward the south at 6:00 P.M., local civil time. Its distance from the earth will increase from about 440 million miles to about 520 million miles, and its apparent diameter will decrease from about 39 to about 33 seconds of arc. On August 27 at 5:00 P.M. Jupiter will be in conjunction with Mars (Jupiter 2°.2 N). Conjunction with the moon will occur on July 11 at 1:00 A.M. (Jupiter 6°.2 N), and on August 7 at noon (Jupiter 6°.0 N).

Saturn will be a night object in western Aquarius. Opposition with respect to the sun will occur on August 30 at 10:00 P.M. Thus during the latter part of this period Saturn will be visible most of the night hours. Its distance from the earth will decrease from about 866 to about 810 million miles, and its apparent diameter will increase from about 16 to about 17 seconds of arc. It will be in conjunction with the moon on July 19 at 7:00 A.M. (Saturn 6°.4 S), and on August 15 at 2:00 P.M. (Saturn 6°.3 S).

Uranus will be a morning object in southwestern Aries rising soon after midnight. On July 29 at 6:00 A.M. Uranus will be at quadrature west of the sun. On July 23 at 4:00 A.M. Uranus will be in conjunction with the moon (Uranus 6°.0 S), and again on August 19 at 11:00 A.M. (Uranus 5°.8 S). The distance of Uranus from the earth will be about 1840 million miles, and its apparent diameter will be about 3¼ seconds of arc. Its position on August 2 will be, R.A. $2^h\,13^m$, Decl. +12° 52′.

Neptune will continue as an evening object in Leo about a degree west of χ Leonis. At the beginning of July it will set about four hours after the sun, but,

by the end of August, it will be too near the sun, in apparent position, to be of interest. On July 24 at midnight it will be in conjunction with Venus (Neptune 2°.6 N). Conjunction with the moon will occur on July 6 at 1:00 A.M. (Neptune 5°.6 N), and on August 2 at 10:00 A.M. (Neptune 5°.6 N). Its distance from the earth will be about 2860 million miles, and its apparent diameter will be about 2⅓ seconds of arc. Its position on July 13 will be: R.A. $10^h\ 57^m$, Decl. +7° 46′.

OCCULTATION PREDICTIONS

(Taken from the *American Ephemeris.*)

The quantities in the columns *a* and *b* are given for the purpose of making these predictions useful for any place within 200 miles of the point indicated. The procedure is as follows: Subtract the longitude of the point given from the longitude of the place in question; multiply the result, taking the signs into account, by the quantity under *a* for the star to be observed; similarly, with the latitude, using *b*; apply the sum of the products, with its proper sign, to the Greenwich C.T., and obtain the predicted Greenwich Civil Time for the phenomenon at the place of observation. To obtain Eastern Standard Time it is necessary to subtract five hours; Central Standarrd Time, six hours, etc.

					IMMERSION				EMERSION			
Date 1935		Star	Mag.	Greenwich C.T.	*a*	*b*	Angle E from N		Greenwich C.T.	*a*	*b*	Angle E from N
				h m	m	m	°		h m	m	m	°
Occultations Visible in Longitude +72° 30′, Latitude +42° 30′.												
July	7	*c* Leo	5.1	2 13.1	..	..	182		2 41.3	..	..	234
	10	87 Vir	5.8	3 33.4	..	..	189		3 44.1	..	..	208
	12	153 B.Lib	6.3	2 59.1	—1.6	—0.6	75		4 11.7	—1.5	—1.8	302
	13	α Sco	1.2	1 30.6	—1.9	—0.7	107		2 52.7	—1.9	—0.4	268
	13	116 B.Sco	6.2	2 44.3	—1.9	—0.8	118		3 57.4	—1.5	—0.5	248
	15	126 B.Sgr	5.8	7 13.0	—1.2	—1.2	95		8 11.2	—0.1	—0.2	227
	17	υ Cap	5.3	3 7.0	—1.5	+0.7	110		3 59.4	—1.2	+1.9	204
	19	186 B.Aqr	6.2	2 29.5	—0.4	+1.0	110		3 10.1	—0.5	+2.4	197
	20	16 Psc	5.6	9 51.4	—1.3	+0.7	52		11 2.9	—1.2	+0.1	238
	25	36 Tau	5.7	6 26.9	+0.1	+1.2	93		7 19.8	+0.1	+1.8	235
Aug.	6	69 Vir	4.9	0 50.3	..	..	179		1 19.5	..	..	226
	9	48 B.Sco	5.1	0 32.8	—1.9	—1.5	144		1 30.8	—1.7	0.0	232
	10	118 B.Oph	6.2	3 7.0	—0.7	+0.4	35		3 55.5	—1.9	—2.5	314
	13	σ Cap	5.5	7 5.9	—0.4	+0.1	42		8 2.7	—0.6	—1.1	264
	15	θ Aqu	4.3	7 43.1	—1.8	—1.4	100		8 30.8	—0.1	+1.6	192
	20	ε Ari	4.6	10 23.9	—2.5	—2.3	122		11 16.9	—1.4	+3.1	201
	21	104 B.Tau	5.5	5 29.9	—0.7	+0.8	114		6 14.0	+0.2	+2.6	209
Occultations Visible in Longitude +91° 0′, Latitude +40° 0′.												
July	12	153 B.Lib	6.3	2 21.6	—2.2	+0.1	85		3 43.9	—1.9	—1.3	303
	13	α Sco	1.2	1 2.5	—1.1	—0.1	129		2 14.2	—2.1	+0.7	256
	13	116 B.Sco	6.2	2 12.3	—1.6	—0.5	131		3 23.5	—2.2	+0.4	248
	15	126 B.Sgr	5.8	6 49.3	—1.5	—0.3	74		8 1.9	—1.1	—0.5	249
	17	υ Cap	5.3	2 47.0	—0.6	+0.6	118		3 31.9	—1.2	+2.4	206
	18	λ Cap	5.4	7 58.6	—2.4	—0.2	98		8 53.2	—0.4	+1.9	182
	20	16 Psc	5.6	9 26.6	—0.9	+2.0	26		10 34.6	—2.0	+0.1	258
	25	36 Tau	5.7	6 29.6	+0.5	+1.1	81		7 20.4	+0.4	+1.3	251
Aug.	9	48 B.Sco	5.1	0 10.9	..	..	169		0 47.9	..	..	220
	10	118 B.Oph	6.2	2 45.7	..	..	19		3 16.0	..	..	338
	13	σ Cap	5.5	6 58.0	—0.2	+1.4	16		7 45.7	—1.9	—1.8	287
	15	θ Apu	4.3	7 9.9	—1.7	+0.4	72		8 18.5	—0.9	+1.0	216
	20	ε Ari	4.6	9 40.0	—2.3	+0.1	102		10 45.6	—1.2	+2.7	211
	21	104 B.Tau	5.5	5 23.2	+0.1	+1.1	96		6 13.1	+0.3	+1.8	230

	Occultations Visible in Longitude +120° 0′, Latitude +36° 0′.												
July	12	153	B.Lib	6.3	1	32.4	−0.8	−0.3	133	2	46.3	−2.0	+0.5	272
	15	126	B.Sgr	5.8	5	54.1	−2.0	+1.2	59	7	12.9	−2.2	−0.2	277
	17	94	B.Cap	6.0	12	13.2	−1.6	−1.4	101	13	0.9	+0.1	+1.4	197
	18		λ Cap	5.4	7	1.8	−1.4	+1.6	67	8	14.0	−1.5	+1.5	233
	18	96	B.Aqr	6.5	11	39.2	−2.0	−0.5	87	12	39.3	−0.4	+0.4	203
Aug.	10	118	B.Oph	6.2	1	23.9	−2.3	+2.0	58	2	26.0	−1.4	−0.8	319
	10	36	Oph	5.3	6	25.4	−1.2	−0.3	65	7	37.0	−1.3	−1.4	278
	11	67	B.Sgr	6.4	7	25.5	−0.7	+0.5	41	8	25.7	−1.5	−1.6	286
	13		π Cap	5.2	10	49.3	+1.0	+3.0	358	11	16.1	−1.8	−3.6	305
	15		θ Aqr	4.3	6	22.9	−1.1	+2.0	35	7	31.2	−1.9	+0.8	259
	19	47	B.Ari	6.5	12	25.4	−2.0	+0.9	67	13	47.9	−1.8	+0.7	240
	20		ε Ari	4.6	8	57.1	−0.5	+1.8	64	10	4.1	−0.9	+1.6	245
	24	87	B.Gem	5.8	11	34.3	−0.4	+1.2	93	12	43.5	−0.9	+1.1	271

Comet Notes

By G. VAN BIESBROECK

There are no known comets observable at this time except a couple of faint objects that can be recorded only with powerful instruments.

Comet 1935 *a* (Johnson) has continued to loose in brightness during the month of May. When last photographed here (May 11) it appeared as a vague diffuse coma and its magnitude was estimated as faint as 17^{M}. Periodic Comet 1925 II (Schwassmann-Wachmann) has exhibited once more an unusual activity in the beginning of May: on May 4 it appeared as a small round coma as bright as 12^{M}.5. A week later it had lost a couple of magnitudes. When we remember that at the end of March it was fainter than 17^{M} (see p. 306) this shows how much this puzzling object can fluctuate in spite of its great and nearly constant distance from the sun.

To the expected periodic comets 1930 VI and 1929 II mentioned earlier we should add two more which come to perihelion this summer: Periodic Comet Holmes has, however, not been observed since 1906; three appearances have been missed since that time so that the chances of recovery are very small. Next there is Comet Schaumasse, but it will remain too close to the sun for some time and not until the latter part of the summer do the conditions of visibility improve.

Williams Bay, Wisconsin, May 20, 1935.

Variable Stars

Monthly Report of the American Association of Variable Star Observers for April, 1935

With the formation of the American Amateur Astronomical Association, centered in the Middle Western States, it looks as though variable star observing, by the amateur, is due for a big boost. We certainly welcome such an activity and hope that it will not confine its efforts merely to meteor and variable star observing, much as we are in favor of the latter. Under proper guidance such an association can accomplish much of value to astronomy.

Nova Herculis appears to have passed beyond the reach of the average variable star observer. Only those having large telescopes at their disposal can hope to observe the Nova during its faint stages. Will the Nova stage a comeback?

Variable Star Observations Received During April, 1935.

Feb. 0 = J.D. 2427834; March 0 = J.D. 2427862; April 0 = J.D. 2427893.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
S Scl			S Tuc			RV Cas			S Psc			RU And			U Per		
001032			*001862*			004746a			011208			013238			015254		
828	9.9	Ht	849	[12.4	Ht	864	[12.9	Hk	840	11.9	Be	830	12.8	Ch	886	8.6	Ba
832	10.1	dK	857	[13.2	En	890	[13.9	Pf	859	12.3	Bj	842	13.0	Ch	886	9.1	Dl
837	10.3	dK	869	[13.2	Ht	—Cas			S Cas			858	13.0	Ch	886	8.6	Ry
839	10.3	Ht	S Cet			004746b			011272			860	12.9	Bj	886	8.7	Hf
843	10.6	dK	*001909*			864	10.8	Ar	807	13.0	Ch	864	13.2	Ma	886	9.1	Hm
856	11.4	dK	810	11.0	Ch	864	10.7	Hk	853	12.7	Wp	Y And			887	8.4	Kn
X And			844	9.8	Ch	864	10.7	Pb	853	12.5	Wa	013338			887	8.6	Pt
001046			854	9.4	Bj	890	10.5	Pf	854	12.7	Ch	830	9.8	Ch	887	8.7	Jo
810	12.0	Ch	T Phe			W Cas			856	12.5	Fc	837	9.7	Be	888	9.1	Dl
839	9.8	Bm	*002546*			004958			858	12.6	Wa	842	9.3	Ch	888	9.1	Hm
842	9.4	Ch	828	9.6	Ht	830	11.3	Ch	858	12.6	Wp	849	9.3	Hf	889	9.2	Hm
846	9.8	Bm	839	9.7	Ht	853	10.3	B	865	12.1	Hf	853	9.4	B	889	9.0	Dl
855	9.2	Hf	849	9.9	Ht	858	10.6	Ch	876	10.4	Wp	858	9.2	Ch	891	9.2	Hm
858	9.2	Ch	857	10.3	En	862	10.9	Hf	879	10.0	Wp	860	8.9	Bj	892	8.5	Jo
865	9.1	Hf	Y Cep			863	10.8	Cl	879	10.2	Wa	862	9.7	Md	895	9.2	Hm
884	9.9	Cm	003179			868	10.7	Cm	884	10.5	Hf	864	9.6	Ma	895	9.1	Dl
884	9.9	Jo	804	9.5	Ch	884	9.8	Wd	884	9.8	Jo	865	9.7	Hf	896	9.1	Dl
887	10.2	Jo	830	9.2	Ch	884	10.4	Cm	885	9.4	Ra	869	9.6	Md	896	9.2	Hm
889	10.4	Jo	860	10.0	Ch	884	9.6	Jo	885	9.6	Pf	884	9.8	Cm	896	8.8	Hf
890	10.1	Pf	865	10.2	Bj	884	10.5	Hf	886	10.1	Jo	884	10.2	Jo	896	8.7	Jo
896	10.7	Jo	888	10.9	Gy	885	9.6	Ra	887	10.0	Jo	886	10.1	Hf	900	8.6	Jo
T Cet			889	11.2	Jo	887	10.3	Pt	887	9.5	Pt	887	10.5	Jo	XX Per		
001620			U Cas			887	9.7	Jo	888	9.3	Wp	889	10.4	Jo	015654		
841	6.2	Kd	004047a			889	9.7	Jo	888	9.4	Ie	893	10.7	Jo	854	8.2	Ch
T And			830	12.7	Ch	893	9.6	Jo	888	9.6	Hf	X Cas			858	8.4	Lt
001726			859	13.5	Ch	896	9.4	Jo	889	9.6	Hf	014958			865	8.4	Lt
807	8.5	Ch	887	[12.6	Pt	896	9.8	Hf	889	9.3	Wp	853	10.5	B	874	8.4	Lt
816	8.4	Ch	890	[13.9	Pf	900	9.4	Jo	889	9.5	Wa	856	10.9	Fc	890	8.4	Lt
836	9.5	Ch	RW And			U Tuc			889	9.8	Jo	861	11.2	Bs	R Ari		
849	9.8	Hf	004132			*005475*			891	9.4	Wp	862	10.9	Md	021024		
858	11.2	Ch	830	[13.1	Ch	828	12.2	Ht	891	9.4	Wa	884	11.5	Jo	807	10.1	Ch
T Cas			864	13.7	L	836	12.5	Sl	892	9.5	Jo	887	10.8	Jo	846	8.0	Hf
001755			RX Cep			839	13.1	Ht	893	9.4	Jo	887	11.0	Pt	847	8.0	Ch
807	11.0	Ch	004281			841	12.9	Sl	896	9.2	Io	889	11.5	Jo	854	7.8	Ch
829	11.5	Ch	858	7.4	Lt	866	13.7	En	896	9.3	Wa	893	11.7	Jo	864	8.9	Hk
853	11.5	B	865	7.3	Lt	Z Cet			896	9.4	Wp	896	11.7	Jo	864	9.1	Hu
858	11.6	Ch	874	7.3	Lt	*010102*			896	9.5	Hf	900	11.5	Jo	864	7.9	Ma
865	11.7	Hf	884	7.3	Lt	811	8.9	Ch	900	9.3	Cm	U Per			864	8.5	Hf
884	11.5	Wd	V And			840	11.3	Be	900	9.3	Jo	015254			872	8.6	Ah
884	12.2	Jo	004435			844	10.9	Hf	U Psc			842	9.0	Ch	877	9.0	Hf
885	11.6	Ra	830	9.2	Ch	844	11.8	Ch	011712			846	9.0	Hf	884	9.2	Io
887	12.5	Pt	836	10.3	Bm	854	12.4	Bj	830	11.5	Ch	859	8.7	Ch	885	9.5	Sx
887	12.1	Gy	838	9.7	Be	U And			838	12.1	Be	862	8.8	Hf	886	9.1	Hf
887	12.0	Jo	846	10.0	Bm	010940			859	[12.8	Bj	863	8.6	Cl	887	9.7	Pt
889	12.2	Jo	853	11.3	B	830	12.4	Ch	RZ Per			864	8.5	Hk	887	9.7	Jo
896	12.0	Jo	858	10.9	Ch	858	12.5	Ch	012350			864	8.5	Pb	889	9.8	Jo
900	12.0	Jo	858	10.9	Bm	864	13.5	L	830	11.7	Ch	865	8.6	Ry	892	10.2	Jo
R And			864	11.3	Be	UZ And			854	12.5	Ch	868	8.6	Ry	W And		
001838			RR And			011041			887	[12.7	Gy	871	8.7	Ry	021143a		
810	13.8	Ch	004533			830	[13.9	Ch	R Psc			874	8.7	Ry	807	10.5	Ch
834	[12.6	Cm	830	[13.3	Ch	858	13.4	Ch	012502			876	8.6	Cl	854	11.8	Ch
858	13.4	Ch	846	[13.4	Bm	864	13.8	L	830	[13.2	Ch	877	8.6	Ry	865	12.4	Bj
864	[11.0	Ma	860	[12.6	Bj	864	13.4	Ma	839	14.3	Bm	877	8.6	Hf	T Per		
864	13.8	L	864	14.2	L	887	11.0	Jo	846	[13.2	Bm	881	8.6	Ry	021258		
S Tuc			RV Cas			890	10.9	Pf	859	[12.7	Bj	884	8.7	Cm	836	9.3	By
001862			004746a									884	8.5	Jo	841	9.0	Hf
828	[13.2	Ht	830	[13.7	Ch							885	8.7	Cl	855	9.0	Hf

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
T PER			o CET			S PER			R CET			R TRI			T ARI		
021258			*021403*			021558			*022000*			023133			024217		
858	9.0	Lt	846	3.7	Mh	841	9.4	Hf	864	7.8	Hu	864	6.2	Hu	887	8.8	Jo
861	9.4	Cm	846	4.0	Rb	853	9.2	B	865	9.0	Hf	864	5.7	Ma	889	8.8	Jo
865	9.1	Lt	847	4.3	Ch	855	9.8	Pk	870	8.5	Kd	865	6.2	Bj	893	8.6	Jo
869	9.3	Si	847	3.7	Mh	855	9.3	Hf	872	8.5	Hi	866	6.0	Fn	W PER		
876	8.7	Cl	848	3.9	En	858	9.4	Fc	884	8.9	Hm	869	6.5	Sî	024356		
877	8.8	Hf	849	4.0	Rb	861	9.6	Cm	886	8.8	Hm	869	6.5	By	841	9.4	Hf
882	9.0	Fs	849	3.7	Mh	861	9.1	Rb	888	8.9	Hm	872	6.3	Ah	842	9.1	Ch
884	9.0	Wd	851	4.1	Mh	863	9.3	Md	RR PER			874	6.4	Ah	853	9.2	B
884	9.1	Dl	852	4.2	Mh	869	9.9	Si	022150			875	6.5	Si	855	9.1	Hf
884	8.5	Jo	853	4.2	Rb	873	9.2	Cl	841	10.5	Hf	875	6.5	Fn	859	8.9	Ch
885	8.9	Ra	854	4.0	En	882	9.0	Fs	842	10.2	Ch	875	6.5	Ah	863	9.2	Cl
886	9.2	Dl	856	4.4	Ch	884	9.4	Wd	859	10.7	Ch	875	6.0	Hm	864	9.4	Pb
887	9.2	Dl	856	4.6	Kd	884	9.3	Dl	861	11.6	Cm	877	6.5	Hf	864	9.4	Hv
887	8.6	Jo	856	4.2	Mh	884	9.2	Jo	867	11.3	B	879	6.1	Hm	864	9.4	Hk
888	8.6	Cl	857	4.2	En	885	9.3	B	885	11.9	B	883	5.7	Hb	865	9.1	Ry
888	9.2	Dl	858	4.3	En	885	9.2	Sx	885	12.0	Ra	884	5.6	Dl	868	9.1	Ry
888	9.2	Hm	858	4.2	Mh	885	9.3	Ra	886	11.9	Cm	884	6.8	Fn	870	9.4	Hv
889	8.9	Hf	859	4.6	Ch	886	9.2	Cm	RS CET			884	6.9	Cm	871	9.1	Ry
889	8.6	Jo	861	4.4	Rb	886	9.3	Dl	022200			884	6.9	Jo	872	9.4	Hv
890	9.0	Lt	861	4.2	Mh	887	9.3	Dl	858	8.4	Lt	884	6.4	Hm	874	9.1	Ry
891	9.2	Wd	862	4.4	Rb	887	9.3	Rb	865	8.4	Lt	885	7.0	Sx	875	9.3	Hv
893	8.6	Jo	862	4.7	Kd	887	9.1	Jo	R FOR			885	7.0	Ra	876	9.2	Cl
895	9.1	Hm	863	4.5	Pm	887	9.2	Hf	*022426*			886	6.0	Dl	877	9.4	Hv
895	9.2	Dl	863	4.8	Pb	888	9.3	Ch	811	12.8	Ch	886	6.3	Hm	877	9.4	Dl
896	9.3	Dl	863	4.2	Mh	888	9.4	Gy	859	11.9	Bj	887	7.0	Jo	877	9.1	Ry
896	9.1	Kg	864	4.5	En	888	9.3	Dl	U CET			888	6.7	Wd	877	9.6	Ra
896	9.1	Hm	864	3.9	Dh	888	9.0	Hm	*022813*			888	5.7	Dl	877	9.4	Hf
896	8.7	Jo	864	3.9	Ar	889	9.0	Sz	811	10.6	Ch	888	6.4	Hm	877	9.4	Hm
900	8.6	Jo	864	4.6	Hv	889	9.0	Jo	837	8.5	Ch	889	6.6	Hm	879	9.2	Hv
900	9.1	Dl	864	3.9	Pb	889	9.2	Hm	840	8.2	Be	889	7.0	Hf	879	9.4	Dl
Z CEP			865	4.5	Hf	889	9.2	Hf	841	8.5	Hf	889	5.7	Dl	879	9.4	Hm
021281			865	5.0	Rb	890	9.4	Fr	844	8.4	Hf	889	7.1	Jo	881	9.3	Hv
804[	11.5	Ch	865	4.3	Mh	891	9.4	Wd	849	8.2	Hf	891	7.5	Sf	881	9.2	Ry
871[	12.5	Ra	866	5.0	Si	892	9.3	Md	854	7.6	Cm	891	6.5	Hm	884	9.2	Hb
888[	13.5	Gy	866	4.8	Kd	892	9.3	Es	858	8.1	Lt	893	7.0	Jo	884	9.3	Dl
o CET			866	4.3	Mh	893	9.2	Jo	858	8.5	Hm	894	6.8	Hb	884	9.4	Jo
021403			866	4.7	En	895	9.2	Hm	859	8.0	Fc	895	6.5	Dl	884	9.1	Hm
803	2.7	Df	868	5.3	Kd	895	9.3	Dl	859	8.0	Ch	895	6.7	Hm	885	9.3	Hv
804	2.6	Ch	868	4.3	Mh	896	9.4	Dl	859	8.0	Bj	896	6.6	Hm	885	9.4	Cl
807	2.6	Ch	869	5.2	By	896	9.3	Kg	865	8.4	Hf	896	6.6	Dl	885	9.1	B
810	2.7	Ch	869	5.2	Si	896	9.1	Jo	RR CEP			896	7.5	Jo	885	9.5	Sx
813	2.8	Ch	870	4.7	Rb	896	9.2	Hm	022980			900	7.7	Jo	886	9.6	Mc
813	3.0	Df	870	4.9	Hv	898	9.3	Es	856	10.7	Fc	T ARI			886	9.5	Dl
818	2.9	Ch	870	5.6	Kd	898	9.3	Md	860	10.4	Ch	024217			886	9.3	Ry
824	3.5	Ch	870	4.8	En	900	9.2	Dl	888	9.7	Gy	836	8.8	By	886	9.2	Hm
824	3.2	Df	872	5.0	Hv	900	9.2	Jo	R TRI			849	8.7	Hf	887	9.2	Jo
827	3.6	Ch	872	5.2	Ah	906	8.8	Pt	023133			858	8.7	Fc	888	10.0	Bk
830	3.8	Ch	873	5.7	Kd	R CET			807	8.4	Ch	859	8.5	Fc	888	9.5	Dl
833	4.0	Ch	875	5.8	Hm	*022000*			836	6.8	By	859	8.0	Ch	888	9.3	Hm
834	3.5	Df	876	5.1	Ra	829	7.9	Ch	842	6.3	Kd	859	8.6	Bj	889	9.2	Jo
836	3.7	By	876	5.0	Pm	837	7.5	Ch	842	5.9	Ch	861	8.8	Bs	889	9.4	Hf
837	4.0	Ch	879	5.6	Hm	838	7.6	Be	847	5.8	Ch	864	7.8	Hu	889	9.3	Hm
838	4.0	Be	884	5.8	Hm	841	7.7	Kd	849	6.0	Hf	865	8.8	Hf	890	10.5	Fr
840	3.8	Ch	886	6.1	Hm	849	7.6	Hf	853	6.0	B	869	8.2	Si	891	9.2	Hm
843	4.0	Ch	888	6.3	Hm	856	7.7	Kd	856	5.8	Ch	869	8.3	By	893	9.3	Jo
844	4.4	Hf	S PER			859	7.8	Ch	858	8.7	Fc	884	8.5	Jo	895	9.4	Dl
845	4.1	Rb	021558			859	7.9	Bj	859	5.7	Fc	884	8.5	Hf	895	9.3	Hm
845	3.6	Mh	836	8.8	By	862	7.9	Kd	864	6.4	Hf	885	9.0	Sx	896	9.1	Hm

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
W PER			Y PER			R PER			U CAM			R TAU			W TAU		
024356			032043			032335			033362			042209			042215		
896	9.1	Jo	841	9.0	Hf	887	9.3	Kn	900	7.6	Jo	884	10.6	Be	890	11.0	Fr
896	9.5	Dl	842	8.3	Ch	887	9.2	Bs	U ERI			884	10.5	Jo	890	10.9	Af
899	9.5	Dl	855	9.2	Hf	887	8.9	Rb	*034625*			885	10.2	Ra	891	10.3	Wd
899	9.4	Hm	855	8.8	Pk	887	9.0	Jo	811	10.5	Ch	885	10.3	Bm	892	10.7	Es
900	9.4	Jo	858	9.1	Fc	888	9.1	Cl	845	13.0	Ch	885	10.0	Hb	892	10.6	Md
906	9.5	Pt	859	9.1	Fc	888	9.0	Ma	867	13.6	Bj	886	10.3	Hf	893	10.7	Jo
R HOR			859	8.1	Ch	888	8.9	Wd	X PER			887	10.6	Jo	895	10.5	B
025050			861	8.9	Bs	889	9.0	Jo	034930			887	10.7	Bs	896	10.6	Bs
828	12.0	Ht	862	9.2	Fc	892	9.3	Es	852	6.4	Lt	888	10.5	Wd	897	10.1	Ba
836	11.9	Sl	863	9.0	Cl	892	9.2	Md	858	6.4	Lt	888	10.5	Sx	S TAU		
837	11.6	dK	864	9.3	Hk	893	9.0	Jo	865	6.4	Lt	888	10.2	Cm	042309		
839	12.3	Ht	864	9.5	Hu	896	8.8	Jo	874	6.5	Lt	889	10.0	Bj	839	15.0	Bm
843	11.7	dK	864	9.3	Hv	896	9.2	Bs	882	6.5	Lt	889	10.8	Jo	846	13.1	Bm
856	12.3	dK	870	9.4	Hv	896	8.9	Hf	886	9.0	Mc	890	10.1	Fr	856	12.8	Bj
857	12.9	Ht	872	9.3	Hv	900	8.7	Jo	890	6.5	Lt	890	10.2	Af	861	14.0	Bs
857	12.6	En	873	9.3	Ah	903	8.8	Md	T ERI			891	10.3	Es	864	13.0	Hk
860	12.6	Sl	874	9.5	Ah	906	8.3	Pt	*035124*			892	10.3	Md	885	14.8	Bm
862	12.9	Ht	875	9.3	Hv	NOV PER			811	12.3	Ch	893	11.0	Jo	887	13.5	Bs
866	12.6	En	875	9.5	Ah	032443			845	12.5	Ch	894	10.8	B	888	13.0	Cm
869	13.0	Ht	877	9.6	Ra	864	12.9	Ar	857	12.1	En	896	11.0	Bs	889	13.0	Bj
T HOR			877	9.3	Hv	864	12.7	Hk	866	12.0	En	896	11.4	Jo	891	14.2	Es
025751			877	9.6	Hf	864	12.7	Pb	867	13.0	Bj	906	11.8	Pt	896	13.5	Bs
828	9.5	Ht	879	9.4	Hv	865	12.6	Bj	W ERI			W TAU			T CAM		
836	8.0	Sl	879	9.2	Cl	872	12.6	Ar	*040725*			042215			043065		
839	8.5	Ht	881	9.4	Hv	873	12.6	Ar	811	10.7	Ch	838	11.3	Be	804	9.7	Ch
849	8.4	Ht	884	8.8	Hb	877	12.9	Ar	845	8.9	Ch	841	11.5	Hf	858	12.3	Fc
857	8.6	Ht	884	9.6	Jo	885	13.0	Ar	857	8.3	Bj	842	10.7	Ch	859	12.1	Fc
857	9.0	En	884	8.8	Wh	888	13.1	Ar	T TAU			853	11.4	B	859	12.0	Ch
860	8.5	Sl	885	9.5	Hv	890	13.0	Ar	041619			856	11.3	Fc	861	12.4	Fc
862	9.1	Ht	885	9.5	Sx	900	12.2	Jo	839	10.4	Bm	858	11.2	Fc	862	12.6	Fc
866	8.9	En	887	9.6	Bs	U CAM			846	10.5	Bm	859	11.4	Fc	888	13.0	Wd
869	9.6	Ht	887	9.4	Jo	033362			858	10.4	Bm	861	11.0	Bs	906	11.9	Pt
ρ PER			888	9.6	Wd	841	8.2	Hf	869	10.3	Bm	861	11.3	Fc	RX TAU		
025938			889	9.6	Jo	845	8.2	Hf	885	10.4	Bm	862	11.2	Fc	043208		
792	3.4	Lt	893	9.5	Jo	849	8.3	Hf	R TAU			863	10.6	Dh	838	10.6	Be
804	3.4	Lt	894	9.7	Hb	862	8.2	Hf	042209			864	10.7	Dh	842	10.4	Ch
817	3.5	Lt	896	9.6	Bs	865	8.2	Hf	839	8.4	Bm	864	11.2	Cl	856	10.3	Fc
858	3.4	Lt	896	9.5	Jo	866	8.0	Si	841	9.4	Hf	864	11.6	Pb	856	9.9	Bj
U ARI			896	9.7	Hf	877	8.2	Dl	842	8.8	Ch	864	11.5	Hu	859	10.4	Fc
030514			900	9.7	Jo	877	8.2	Hm	846	9.4	Bm	864	11.7	Hk	861	9.9	Rb
839	14.6	Bm	906	9.7	Pt	879	8.3	Hm	855	9.8	Hf	865	11.2	Rb	862	10.2	Fc
842	13.4	Ch	R PER			884	8.3	Hm	856	9.2	Bj	870	11.6	Dh	870	10.2	B
858	14.4	Bm	032335			884	7.6	Jo	858	9.4	Fc	872	11.2	Dh	884	10.3	Sf
859	14.0	Ch	842	12.6	Ch	886	8.3	Hm	858	9.2	Bm	872	11.3	Hk	884	10.6	Be
869	14.0	Bm	853	11.1	B	887	7.5	Jo	859	9.3	Fc	872	11.2	Ar	884	10.6	Jo
887	12.6	Gy	854	11.0	Ch	888	8.2	Hf	861	9.5	Bs	877	10.5	Dh	886	10.3	Rb
X CET			856	11.3	Fc	888	8.3	Hm	861	9.6	Cm	879	10.6	Dh	886	9.9	Hf
031401			861	11.1	Rb	889	8.3	Hm	862	9.7	Hf	883	10.6	Cl	887	10.5	Jo
842	12.0	Ch	861	10.8	Bs	889	7.6	Jo	862	9.2	Fc	884	10.9	Wd	888	10.3	B
843	12.5	B	864	11.0	Ma	891	8.3	Hm	864	10.0	Hk	884	10.9	Be	889	10.2	Bj
857	11.5	Bj	865	10.8	Bj	893	7.3	Jo	864	9.7	Ma	884	10.4	Jo	889	10.5	Jo
864	11.2	Hu	865	10.7	Hf	895	8.3	Hf	864	9.7	Hu	885	10.5	Dh	891	10.6	Sf
868	10.9	B	883	10.1	Wu	895	8.7	Hm	864	10.0	Pb	885	10.7	B	893	10.5	Jo
869	10.0	Si	884	9.1	Hf	896	8.5	Hm	869	9.8	Bm	886	10.6	Rb	897	10.4	Hf
884	10.0	Jo	884	8.9	Sh	897	7.6	Jo	871	9.9	Cm	887	10.6	Bs	R RET		
887	10.0	Jo	884	9.3	Jo	899	8.9	Hm	873	9.7	Hi	887	10.4	Jo	*043263*		
889	9.9	Jo	885	9.0	Hb	899	8.9	Dl	882	9.9	B	888	11.1	Ba	828	9.9	Ht
			885	9.2	B	900	8.7	Dl	884	10.1	Hi	889	10.5	Jo	836	10.3	Sl

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
R RET			R PIC			R LEP			V ORI			T PIC			S AUR		
043263			*044349*			*045514*			050003			*051247*			052034		
839	10.4	Ht	859	7.3	Ht	865	9.5	Kn	885	10.1	Hk	856	8.4	dK	901	10.7	B
849	11.2	Ht	865	7.2	Ht	866	8.5	Sq	887	9.8	Jo	857	8.4	En	906	11.0	Pt
857	11.2	Ht	866	7.3	En	870	8.8	Hh	888	10.3	Cm	859	8.9	Ht	W AUR		
857	11.4	En	V TAU			871	9.3	Kp	889	10.5	Bj	865	9.0	Ht	052036		
860	11.4	Sl	044617			872	9.5	Je	889	10.2	Jo	866	8.8	En	838	10.1	Be
862	11.6	Ht	838	9.7	Be	873	9.7	Ra	893	10.2	Md	NOV TAU			854	11.4	Hf
866	11.7	En	843	9.8	Ch	877	8.8	Wd	893	10.0	Jo	051316			856	11.4	Fc
869	12.5	Ht	856	10.8	Bj	879	9.5	Hm	894	10.5	B	864	14.8	Ar	858	11.4	Fc
X CAM			858	11.2	Fc	884	9.5	Hb	895	10.2	Hf	885	14.8	Ar	858	11.5	Ch
043274			868	12.3	B	884	9.0	Jo	896	10.4	Jo	888	14.4	Ar	859	11.8	Fc
804	11.7	Ch	884	13.8	L	884	8.9	Hf	900	10.6	Jo	890	14.4	Ar	861	11.7	Fc
829	9.7	Ch	887	13.7	Bs	885	9.5	Sx	T LEP			T COL			862	11.9	Fc
846	9.9	Hf	888	13.6	B	885	9.5	Rc	*050022*			*051533*			864	11.9	Cm
858	10.0	Fc	896	13.3	Bs	886	9.0	Hh	839	8.4	Bm	839	12.0	Ht	864	12.0	Ma
859	10.1	Fc	AB AUR			886	9.5	Dl	844	8.0	Ch	841	11.9	Kd	873	12.3	Hi
859	9.8	Ch	044930			886	9.5	Hm	849	8.5	Hf	849	11.8	Ht	883	12.3	B
861	10.2	Fc	858	6.9	Lt	886	9.4	Kp	853	9.7	Wa	856	11.2	Kd	884	13.1	Be
862	10.2	Fc	865	6.9	Lt	887	8.2	Jo	853	9.0	Wp	857	11.0	En	884	13.0	Hi
862	10.1	Hf	874	6.9	Lt	888	9.5	Dl	854	8.6	Bm	859	10.8	Ht	888	12.9	Wd
867	10.3	Kn	887	6.9	Lt	888	9.5	Hm	857	8.4	En	865	10.8	Ht	888	13.0	Cm
884	12.0	B	898	6.9	Lt	889	9.6	Dl	859	8.5	Bj	866	10.5	En	888	12.5	Ma
887	12.0	Jo	R ORI			889	8.4	Jo	859	8.5	Fc	867	11.0	Kd	894	13.2	B
887	12.1	Kn	045307			889	9.4	Hm	862	8.6	Hf	869	10.8	Kd	906	12.0	Pt
888	11.6	Hf	843	9.5	Ch	891	9.6	Bk	864	8.8	Hu	871	10.7	Kd	S ORI		
888	12.6	Wd	849	9.3	Be	891	9.6	Hm	866	8.6	En	S AUR			*052404*		
889	12.1	Jo	856	9.7	Fc	893	8.2	Jo	869	8.6	Bm	052034			816	9.0	Ch
892	12.7	Es	857	10.2	Bj	895	9.6	Hm	877	8.8	Wd	816	9.8	Ch	844	9.4	Ch
892	12.6	Md	858	10.2	Fc	895	9.6	Dl	883	8.8	B	849	9.6	Be	846	10.0	Hf
896	12.5	Jo	859	10.3	Fc	896	9.6	Dl	884	8.7	Io	849	10.6	Hf	849	9.5	Be
897	12.8	B	861	10.1	Fc	896	9.5	Hm	884	9.0	Hf	856	10.9	Fc	853	9.5	B
906	12.6	Pt	862	9.9	Fc	896	9.3	Rc	885	9.2	Bm	858	11.4	Ch	854	10.0	Hf
R DOR			862	10.4	Md	W ORI			887	8.8	Jo	858	11.1	Fc	856	10.1	Fc
043562			864	10.4	Cm	050001			889	9.2	Jo	859	10.8	Fc	857	10.0	Bj
828	5.6	Ht	873	10.2	Hk	884	6.5	Jo	894	9.0	B	861	11.0	Fc	858	10.0	Fc
836	5.3	Sl	877	10.3	Hk	V ORI			898	8.8	Bj	862	11.1	Fc	859	9.8	Ch
839	5.7	Ht	883	10.1	B	050003			S PIC			862	10.8	Hf	861	10.2	Rb
841	5.5	Sl	884	10.4	Be	839	10.2	Bm	*050848*			865	11.1	Rb	864	10.3	Hu
849	5.6	Ht	885	10.4	Hk	843	10.0	Ch	839	12.9	Ht	869	10.9	Si	864	11.2	Ma
857	5.6	Ht	886	10.3	Hf	849	9.3	Hf	857	12.9	En	876	11.7	Wp	868	10.1	Cm
857	5.8	En	888	10.3	Cm	849	9.6	Be	865	13.4	Ht	883	10.6	B	870	10.1	Cm
860	5.8	Sl	889	10.8	Bj	853	9.3	Wa	R AUR			885	10.5	Ra	870	10.0	Dh
862	5.5	Ht	894	10.6	B	853	9.4	Wp	050953			886	11.0	Ba	870	10.3	Hk
866	5.8	En	897	10.7	Hf	854	9.4	Bm	858	13.0	Ch	886	9.6	Mc	876	10.2	Wp
869	5.6	Ht	R LEP			857	9.6	Bj	861	13.0	Bs	886	10.3	Dl	877	10.2	Dh
R CAE			*045514*			862	9.3	Fc	864	12.2	Cm	887	10.4	Dl	877	10.5	Ar
043738			816	7.0	Ch	862	9.2	Hf	885	12.5	Ra	887	11.0	Rb	877	10.4	Hk
839	9.2	Ht	836	7.1	Sl	864	9.4	Cm	887	12.6	Bs	887	9.6	Jo	877	10.1	Wd
849	9.7	Ht	837	8.9	Df	869	9.3	Bm	888	12.1	Wd	888	10.8	Hf	877	10.4	Dl
857	9.7	En	841	7.1	Sl	870	9.3	Hk	888	12.0	Cm	888	11.5	Gy	877	10.4	Hm
859	10.1	Ht	844	9.2	Ch	877	9.6	Hk	896	12.2	Bs	888	11.2	Wd	884	10.1	Cl
865	10.0	Ht	844	9.1	Df	877	9.4	Wd	906	11.5	Pt	888	10.2	Dl	884	10.4	Jo
866	9.9	En	849	9.2	Hf	879	9.3	Cl	T PIC			892	9.5	Jo	884	10.3	Hf
R PIC			854	8.3	Pk	883	9.7	B	*051247*			893	9.6	Jo	885	10.2	Dh
044349			860	7.5	Sl	884	10.0	Sh	839	8.1	dK	894	10.7	B	885	10.1	Hk
839	7.5	Ht	862	9.3	Hf	884	9.5	Jo	839	8.0	Ht	895	10.4	Dl	885	10.2	Ra
849	7.5	Ht	863	9.7	Pb	884	10.0	Hf	843	8.0	dK	896	10.4	Dl	885	10.0	B
857	7.3	En	864	9.7	Pb	885	9.9	Bm	849	8.1	dK	896	10.0	Jo	886	10.4	Rb
			864	9.2	Ma	885	9.9	Ra	849	8.6	Ht	897	10.5	Ba	886	10.3	Dl

Variable Star Observations Received During April, 1935.

J.D. Est. Obs.	J.D. Est. Obs.	J.D. Est. Obs.	J.D. Est. Obs.	J.D. Est. Obs.	J.D. Est. Obs.
S Ori	T Ori	AN Ori	RR Tau	U Aur	SU Tau
052404	*053005a*	*053005t*	053326	053531	054319
887 10.5 Jo	879 10.0 Lf	872 11.6 Dh	854 11.4 Fc	884[13.4 B	888 9.9 Hf
888 10.2 Hm	879 10.5 Kt	873 11.5 Lf	854 11.3 Bm	897[13.5 B	889 10.0 Wa
888 10.3 Dl	879 10.2 Wp	873 11.6 Pb	855 11.7 Fc	SU Tau	889 9.7 Rb
888 10.0 Cm	879 10.2 Wa	873 11.6 Ar	856 11.4 Fc	054319	889 10.1 Gy
889 10.6 Jo	884 9.9 Wd	873 11.5 Hu	858 11.5 Fc	804 9.9 Ch	889 9.9 Hf
890 10.7 Fr	884 9.6 Hf	874 11.7 Pb	859 12.1 Fc	810 9.7 Ch	889 10.0 Wp
890 10.7 Af	884 9.9 Cm	874 11.4 Ra	862 12.0 Fc	816 9.5 Ch	890 10.0 Ar
891 10.1 Es	884 10.3 Jo	877 11.7 Ar	863 12.4 Br	836 9.6 Ch	890 10.0 Ma
895 10.1 B	885 9.7 Ar	877 11.6 Pb	864 12.4 Ar	836 10.1 Fc	891 10.2 Wa
895 10.2 Dl	885 9.7 Ra	877 11.4 Dh	865 12.5 Ry	838 10.1 Fc	891 10.1 Br
895 10.5 Hm	885 9.6 Hk	879 11.3 Wp	868 12.7 Ry	851 10.0 Fc	891 10.2 Wd
896 10.3 Hf	885 10.0 Sx	879 11.5 Lf	869 12.6 Bm	854 9.9 Fc	891 10.4 Wp
896 10.1 Dl	885 9.7 Dh	879 11.7 Ar	872 12.9 Ar	855 9.9 Fc	895 10.6 Wp
897 10.2 Bj	885 9.9 Kt	879 11.2 Wa	872 13.1 Ry	856 9.8 Fc	895 10.2 Hf
897 10.7 Jo	885 10.2 B	879 11.6 Dh	876 11.9 Wp	858 9.9 Fc	895 10.7 Wa
900 10.2 Dl	886 9.8 Hf	884 11.7 Wd	877 12.3 Ar	858 9.6 Ch	896 10.2 Sf
901 10.1 B	886 9.7 Rb	885 11.7 Dh	877 11.4 Ry	859 9.9 Fc	896 10.2 Hf
T Ori	886 10.3 Jo	885 11.6 Hk	879 11.9 Wa	862 9.9 Fc	896 10.4 Wp
053005a	887 10.0 Bs	885 11.7 Ar	879 11.9 Wp	863 9.6 Br	896 9.7 Jo
805 10.4 Ch	887 10.4 Jo	888 11.8 Pb	881 11.6 Ry	864 9.5 Hu	896 10.6 Wa
844 10.8 Ch	888 9.8 Pb	888 12.0 Ar	882 11.5 Ry	864 9.5 Ma	897 10.2 Hf
859 10.4 Ch	888 9.8 Ar	889 11.4 Cm	883 11.7 B	864 9.9 Ar	897 10.1 Bj
863 10.5 Dh	888 9.7 Hf	890 11.8 Ar	883 11.5 Ry	866 9.9 Hu	897 10.0 B
863 10.6 Ar	889 9.8 Hf	897 11.2 Wa	884 11.5 Wa	866 9.9 Si	900 9.8 Jo
863 10.8 Pb	889 9.8 Cm	S Cam	884 11.4 Wp	868 9.8 Mi	906 9.9 Pt
864 10.8 Kt	889 10.4 Jo	053068	884 11.3 Be	870 9.9 Ar	S Col
864 10.7 Pb	890 9.6 Ar	804 9.8 Ch	885 12.0 Bm	872 9.8 Ar	*054331*
864 10.8 Dh	890 9.8 Af	849 9.3 Hf	885 12.3 Ar	873 9.9 Ar	837 10.0 dK
864 10.2 Hu	890 9.8 Fr	858 8.9 Fc	886 12.0 Wa	876 9.9 Wp	839 9.8 Ht
864 10.8 Ar	890 9.6 Kt	859 9.1 Fc	886 12.3 Ry	877 9.9 Wd	843 9.8 dK
864 9.8 Ma	891 9.6 Es	859 8.6 Ch	886 11.4 Wp	877 9.8 Ar	849 9.7 dK
866 10.1 Hu	891 9.8 Wd	865 9.0 Hf	887 11.8 Gy	879 9.6 Wa	849 9.1 Ht
866 9.5 Si	893 10.2 Jo	866 8.7 Fn	888 11.8 Cm	879 9.9 Wp	856 9.7 dK
870 10.3 Ar	895 9.5 Hf	884 9.2 Sh	888 12.2 Pb	879 9.9 Ar	857 9.7 En
870 10.4 Hk	895 10.2 B	884 8.4 Jo	888 12.0 Gy	883 9.8 Gy	859 9.5 Ht
870 10.3 Dh	896 10.5 Jo	884 9.1 Hf	888 12.3 Ar	883 9.7 Jo	865 9.6 Ht
872 10.3 Ar	896 9.6 Hf	887 8.4 Md	888 12.1 Wp	884 9.6 B	866 9.9 En
872 10.4 Hk	896 9.9 Bs	887 8.7 Kn	888 12.2 B	884 9.8 Hf	Z Tau
872 10.3 Dh	897 9.6 Hf	887 8.5 Jo	889 12.0 Gy	884 9.9 Wa	054615a
872 10.6 Kt	897 10.0 Wa	889 9.0 Fn	889 12.1 Wp	884 9.8 Be	839 12.8 Bm
873 10.4 Pb	897 10.0 Bj	893 8.4 Jo	889 12.0 Rb	884 10.0 Wp	854 13.4 Bm
873 10.1 Hu	900 10.6 Jo	895 8.8 Hf	889 12.2 Wa	884 10.0 Sh	858 13.2 Ch
873 10.4 Lf	906 9.7 Pt	895 8.6 Md	890 12.4 Ar	884 9.8 Jo	864 13.1 Ma
873 10.7 Kt	AN Ori	896 8.5 Jo	891 13.2 Wp	885 10.0 Ar	865 13.3 Wp
873 10.0 Ar	*053005t*	903 8.4 Md	891 13.2 Wa	886 10.0 Wp	865 13.4 Wa
874 10.2 Pf	863 11.6 Dh	906 8.3 Pt	891 12.9 Br	886 9.8 Hf	869 14.0 Bm
874 10.4 Ra	863 11.6 Ar	β Dor	895 11.2 Wa	886 9.9 Wa	871 13.2 Wa
874 10.3 Sx	863 11.8 Pb	*053262*	895 11.4 Wp	887 10.0 Pt	871 13.3 Wp
876 10.6 Wp	864 11.7 Ar	809 4.5 Df	896 11.4 Wp	887 9.7 Jo	885 13.8 Bm
877 9.9 Dh	864 10.8 Ma	813 4.0 Df	896 11.2 Wa	887 10.2 Gy	888 12.9 Ma
877 10.4 Pb	864 11.7 Pb	824 3.9 Df	897 11.2 B	888 9.6 B	888 13.2 Wp
877 10.2 Kt	864 11.6 Hu	837 3.5 Df	RU Aur	888 10.1 Gy	RU Tau
877 10.0 Ar	864 11.6 Dh	RR Tau	053337	888 10.0 Wp	054615c
877 9.9 Kt	866 11.4 Hu	053326	858[13.4 Ch	888 9.9 Sf	839 13.2 Bm
877 10.0 Wd	870 11.5 Dh	836 10.7 Fc	906[12.0 Pt	888 10.0 Pb	854 13.9 Bm
877 10.1 Hf	870 11.4 Ar	838 11.4 Fc	U Aur	888 9.8 Ma	858 13.5 Ch
879 10.1 Ar	872 11.6 Hk	839 11.0 Bm	053531	888 10.0 Ar	864 10.4 Ma
879 10.1 Dh	872 11.6 Ar	851 10.6 Fc	858 13.5 Ch	888 9.9 Ie	869 14.3 Bm

Variable Star Observations Received During April, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
RU Tau			U Ori			U Ori			Z Aur			V Aur			R Mon		
054615c			054920a			054920a			055353			061647			063308		
888	10.4	Ma	857	7.4	Kd	889	9.4	Si	895	10.0	B	809	10.4	Ch	843	13.0	Ch
R Col			858	7.2	Ch	889	9.2	Fn	895	10.2	Hf	856	10.5	Fc	859	12.0	Bj
054629			858	8.7	Bu	890	9.7	Fr	896	10.3	Jo	863	10.2	Md	864	11.9	Dh
844	13.0	Ch	861	8.6	Bs	890	9.8	Af	899	10.4	Hf	871	10.2	Md	864	11.9	Hk
857	12.9	En	864	8.5	Cm	890	8.9	Bu	899	10.6	Wd	871	10.3	Es	864	12.0	Ar
858	13.0	Bj	864	8.6	Hu	891	9.0	Wd	900	10.5	Jo	883	9.5	B	864	11.9	Pb
865	12.2	Ht	865	8.3	Kp	891	9.5	Hm	901	9.9	B	887	9.8	Gy	872	12.0	Ar
866	12.5	En	866	8.8	Hu	892	8.8	Jo	906	10.3	Pt	893	9.4	Md	885	12.7	Ar
898	8.0	Bj	866	7.8	Kd	893	9.0	Md	R Oct			896	9.4	Jo	886	10.7	Jo
α Ori			866	8.5	Si	894	8.9	Hb	*055686*			897	9.7	B	888	12.3	Ar
054907			866	8.1	Sq	895	8.9	B	839	8.8	Ht	898	9.7	Es	888	12.1	Pb
836	0.8	Sl	866	8.5	Fn	895	9.5	Hf	849	9.8	Ht	898	9.7	Md	888	12.7	B
841	0.7	Sl	869	8.6	By	895	9.8	Hm	859	9.9	Ht	900	9.2	Jo	890	12.1	Ar
858	0.7	Lt	870	8.4	Hk	896	9.4	Hm	865	10.4	Ht	903	9.4	Md	893	11.0	Jo
860	0.3	Sl	870	9.3	Hh	896	9.0	Jo	869	10.1	En	V Mon			897	12.2	Bj
865	0.7	Lt	870	7.8	Kd	896	8.9	Rc	X Aur			*061702*			Nov Pic		
866	0.5	Fn	871	8.6	Kp	896	8.8	Bs	060450			809	10.2	Ch	*063462*		
866	0.8	Mh	871	8.3	Md	898	8.8	Kd	809	12.9	Ch	836	8.8	Ch	828	8.9	Ht
868	0.8	Mh	871	8.3	Es	899	9.4	Hm	822	11.8	Ch	836	9.3	By	839	9.1	Ht
869	0.5	Si	872	8.5	Je	900	9.2	Jo	837	10.2	Ch	849	8.5	Hf	849	9.1	Ht
874	0.7	Mh	872	8.5	Ah	903	9.3	Md	843	9.2	Ch	858	6.9	Bj	857	9.1	Ht
875	0.7	Mh	875	8.7	Ah	906	9.8	Pt	845	9.0	Ch	858	7.1	Fc	857	9.0	En
877	0.8	Dl	876	8.7	Cl	TW Aur			845	9.7	Hf	862	7.3	Hf	862	9.1	Ht
877	0.8	Hm	877	8.7	Hk	054945			860	8.7	Ch	864	7.4	Hk	866	9.0	En
881	0.7	Mh	877	8.6	Wd	827	8.1	Lt	862	9.0	Hf	865	7.6	Kp	869	8.9	Ht
882	0.6	Lt	877	8.7	Hf	837	8.0	Lt	863	9.0	Md	866	7.0	Sq	S Lyn		
884	0.9	Dl	879	8.9	Hm	859	8.0	Lt	871	9.3	Md	869	7.3	Si	063558		
884	0.8	Hm	882	8.9	Ah	890	8.2	Lt	871	9.0	Hf	869	7.3	By	810	11.2	Ch
884	0.7	Mh	882	8.8	Fs	V Cam			871	9.3	Es	871	7.5	Kp	836	11.8	Ch
885	0.7	Mh	883	8.8	Gy	054974			883	8.4	B	872	7.2	Je	853	13.3	Bs
886	0.8	Hm	883	8.6	B	859	13.7	Ch	884	8.6	Sh	872	7.6	Hk	858	13.5	Fc
887	0.7	Lt	884	8.7	Kd	888[	13.5	Ie	884	8.6	Sf	877	7.2	Hf	865	13.7	Ry
888	0.8	Hm	884	8.8	Hb	894[	13.3	B	884	8.5	Hf	884	7.4	Jo	869	13.8	Ry
888	0.6	Mh	884	8.8	Sh	906[	12.6	Pt	885	8.4	Ra	885	7.2	Hk	887	13.9	Bs
888	0.9	Dl	884	8.3	Sq	Z Aur			887	8.9	Jo	886	6.9	Hf	896	13.8	Bs
890	0.6	Mh	884	7.0	Be	055353			888	8.4	Wd	886	7.4	Kp	898	13.8	B
892	0.6	Mh	884	7.9	Fn	845	10.5	Hf	889	8.8	Sz	887	7.5	Jo	X Gem		
894	0.6	Mh	884	9.0	Hf	849	10.3	Hf	889	8.7	Kn	890	7.3	Sx	064030		
895	0.8	Hm	885	8.8	Hk	853	10.5	Hf	893	8.8	Md	893	7.0	Jo	843	12.0	B
896	0.8	Hm	885	8.0	Cl	854	10.4	Hf	895	8.7	Sf	896	7.0	Jo	844	11.9	Hf
896	0.6	Mh	885	8.9	Ah	856	10.9	Fc	895	9.0	Hf	896	7.2	Hf	853	11.9	Bs
896	0.8	Dl	885	9.0	Sx	858	11.0	Fc	896	8.7	Io	897	6.8	Bj	856	11.5	Fc
897	0.6	Mh	885	8.8	Ra	861	10.8	Bs	898	8.5	Es	UU Aur			862	11.2	Hf
898	0.6	Mh	885	8.8	Rc	862	10.9	Hf	898	8.8	Md	062938			864	11.3	Ma
898	0.7	Lt	886	9.2	Kd	862	10.8	Fc	898	9.1	B	851	5.6	Lt	884	10.1	Sh
899	0.6	Mh	886	9.7	Hh	865	10.9	Rb	899	9.0	Jo	858	5.6	Lt	884	10.3	Hf
901	0.6	Mh	886	8.8	Bs	876	11.1	Wp	901	9.2	B	865	5.6	Lt	885	9.6	Ra
904	0.6	Mh	886	9.1	Mc	879	11.0	Wp	903	9.4	Md	874	5.6	Lt	887	10.0	Gy
U Ori			886	8.9	Kg	879	10.8	Wa	906	9.3	Pt	886	5.6	Lt	888	10.0	Wd
054920a			886	8.9	Je	883	10.5	B	TV Gem			898	5.8	Lt	888	10.1	Ma
804	5.8	Ch	886	8.9	Kp	884	10.5	Sh	060521			U Lyn			889	9.4	Cm
816	5.8	Ch	886	9.3	Hm	884	10.6	Hf	852	6.9	Lt	063159			890	10.2	Sx
841	7.4	Kd	887	8.8	Jo	887	10.9	Rb	865	6.9	Lt	853	13.0	Bs	891	9.5	Ie
852	7.5	Be	887	8.8	Gy	887	10.3	Jo	887	6.9	Lt	859	13.5	Bj	892	10.0	Jo
853	7.8	Hf	888	8.7	Kd	887	9.9	Gy	η Gem			898	14.0	B	895	10.0	Hf
854	7.4	Kd	888	9.5	Hm	891	10.4	Wa	060822			R Mon			899	9.5	Jo
855	8.1	Hf	889	9.7	Hm	891	10.5	Wp	851	3.4	Lt	063308					
856	7.1	Ch	889	8.7	Cm	893	9.9	Jo				809	12.8	Ch			

Variable Star Observations Received During April, 1935.

J.D.	Est.	Obs.
Y Mon		
065111		
836	11.8	Ch
858	13.5	Fc
858	13.5	Bj
870	13.5	Bs
872	13.4	Hk
887	13.5	Bs
888	13.0	Ma
894	12.7	B
896	13.1	Bs
897	12.6	Bj
X Mon		
065208		
849	8.4	Hf
862	8.3	Hf
864	7.7	Dh
864	7.9	Hk
864	8.0	Hu
864	7.9	Pb
869	8.2	Si
872	7.8	Hk
877	7.8	Hf
886	8.3	Hf
887	8.0	Gy
889	8.1	Hb
889	9.1	Ha
890	7.8	Sx
893	7.7	Jo
896	7.6	Jo
896	8.1	Hf
900	7.6	Jo
R Lyn		
065355		
810	8.9	Ch
836	10.0	Ch
841	10.0	Hf
853	10.5	Hf
856	10.6	Fc
859	10.5	Bj
862	10.9	Hf
864	10.8	Ma
873	11.2	Hk
885	12.0	Ra
888	11.6	Ma
889	11.7	Hf
891	11.8	Ie
898	11.6	Bj
RS Gem		
065530		
852	11.5	Be
856	11.3	Fc
864	11.0	Ma
865	11.6	Rb
872	11.6	Hk
887	11.3	Gy
887	11.3	Be
888	11.5	Ma
888	11.4	Hf
889	11.4	Rb
889	11.6	Cm
892	10.7	Jo
897	11.0	Jo
Z UMa		
065911		
841	10.1	Sl
860	10.1	Sl
V CMi		
070109		
843	12.8	Ch
858	13.5	Bj
883	12.7	Gy
887	14.5	L
897	12.7	Bj
R Gem		
070122a		
804	7.2	Ch
810	7.0	Ch
829	7.2	Ch
841	7.6	Hf
843	7.2	Ch
846	7.2	Rb
852	6.8	Be
854	7.0	Hf
856	6.8	Ch
863	7.4	Br
864	6.9	Hu
870	8.7	Hh
871	7.5	Hf
872	7.6	Hk
872	7.7	Ah
872	7.5	Je
873	7.6	Ah
877	7.5	Ra
878	7.6	Ah
882	7.7	Wd
882	8.0	Fs
882	7.6	Ah
883	7.7	Hb
885	7.6	Je
885	7.8	Ah
886	8.9	Hh
886	7.6	Je
886	7.7	Hf
887	8.0	Jo
887	7.6	Be
889	7.8	Cm
889	8.4	Rb
890	8.1	Sx
890	7.7	Bu
892	8.0	Jo
896	8.2	Jo
896	8.2	Hf
896	8.4	Kg
896	8.5	Wa
897	8.5	Wa
898	7.8	Bu
900	8.3	Jo
R Gem		
070122a		
906	8.1	Pt
Z Gem		
070122b		
854	12.5	Hf
872	12.4	Hk
877	12.5	Ra
896	12.7	Kg
897	12.7	Wa
TW Gem		
070122c		
841	8.4	Hf
851	8.2	Lt
854	8.4	Hf
858	8.2	Lt
871	8.4	Hf
874	8.2	Lt
877	8.3	Ra
882	8.4	Wd
886	8.3	Hf
890	8.4	Sx
890	8.2	Lt
896	8.4	Hf
896	8.5	Kg
R CMi		
070310		
841	8.4	Hf
843	8.2	Ch
858	7.8	Bj
859	8.4	Hf
868	8.5	Mi
870	8.4	Hk
872	8.1	Ah
873	8.0	Ah
877	8.2	Hk
877	8.3	Hf
883	8.3	Gy
883	8.4	B
885	8.3	Hk
885	8.1	Sq
885	8.6	Ah
886	8.7	Hf
887	8.0	Jo
887	7.4	Be
838	8.5	Sf
890	8.4	Sx
890	8.0	Kn
891	8.3	Sq
892	8.2	Jo
896	8.2	Jo
896	8.8	Hf
896	8.7	Sf
897	8.0	Bj
899	8.7	Wd
900	8.0	Jo
906	8.0	Pt
R Vol		
070772		
828	12.5	Ht
839	13.0	Ht
857	12.8	Ht
857	13.0	En
866	13.4	En
869	13.4	Ht
L$_2$ Pup		
071044		
836	4.6	Sl
841	4.6	Sl
842	5.2	Kd
857	4.6	Kd
860	4.2	Sl
866	4.6	Si
866	4.8	Kd
866	4.5	Fn
868	4.9	Kd
887	4.7	Kd
RR Mon		
071201		
836	11.8	Ch
858	12.8	Bj
863	13.2	Br
885	14.9	Ar
897	12.8	Bj
V Gem		
071713		
836	9.3	Ch
843	9.3	B
863	11.0	Br
865	11.0	Bj
872	11.8	Hk
887	12.0	Be
889	12.9	Bj
898	13.0	B
S CMi		
072708		
804	10.1	Ch
822	9.5	Ch
843	8.8	Ch
849	8.7	Hf
857	8.6	Ha
858	8.4	Bj
862	9.1	Md
864	8.8	Cm
864	8.5	Hv
864	8.7	Ha
865	8.6	Hf
866	8.6	Ha
866	8.8	Fn
869	8.6	Si
870	8.4	Cm
870	8.6	Hk
877	8.6	Hk
877	8.7	Ar
877	8.7	Hf
879	8.3	Hm
879	9.0	Dl
S CMi		
072708		
881	8.5	Hv
883	8.1	Wh
884	8.6	Dl
884	8.4	Fn
894	7.9	Hm
885	8.3	Hk
885	8.2	Hv
885	8.7	Ha
886	8.7	Dl
886	8.5	Hf
886	8.2	Hm
887	8.6	Md
887	8.9	Dl
887	8.5	Jo
887	8.3	Be
888	8.2	Hm
888	8.8	Dl
889	8.3	Bj
889	8.8	Fn
889	8.2	Rb
889	8.2	Hm
890	8.3	Kn
890	8.6	Sx
890	8.4	Ha
890	8.2	Cm
892	8.1	Jo
893	8.5	Md
895	8.9	Dl
895	8.0	Hm
896	8.0	Hm
896	8.3	Hf
896	8.8	Dl
896	8.3	Jo
898	8.4	Md
898	8.3	Es
899	7.9	Wd
899	7.7	Jo
899	8.4	Hm
899	8.6	Dl
902	8.0	Pg
903	7.9	Md
906	7.6	Pt
T CMi		
072811		
843	11.6	Ch
859	12.0	Bj
863	11.6	Br
870	11.7	Hk
889	12.4	Bj
890	12.4	Be
894	12.7	B
Z Pup		
072820b		
843	8.9	Ch
854	8.6	Bm
859	9.5	Bj
866	9.7	Si
866	10.3	En
Z Pup		
072820b		
868	9.7	Mi
872	10.0	Hk
877	10.2	Hk
885	10.5	Dh
885	10.5	Hk
885	9.9	Rc
887	10.0	Gy
889	10.2	Wp
889	10.3	Wa
889	10.2	Bm
891	10.4	Wa
891	10.3	Wp
898	10.2	Bj
899	10.5	Jo
S Vol		
073173		
828	13.2	Ht
857	12.8	En
869	13.2	Ht
U CMi		
073508		
836	9.7	Ch
849	10.0	Hf
858	9.3	Bj
863	10.0	Br
865	10.2	Hf
870	10.4	Hk
877	9.3	Hk
885	9.3	Hk
885	9.2	Ar
887	9.5	Jo
888	9.3	B
889	9.0	Bj
890	9.3	Be
890	9.4	Kn
893	9.0	Jo
896	8.9	Jo
899	9.2	Hf
899	9.2	Wd
906	8.5	Pt
S Gem		
073723		
809	9.8	Ch
836	11.4	Ch
841	11.7	Hf
854	11.8	Hf
854	12.0	Ch
864	12.6	Cm
868	12.7	Mi
870	12.9	Bs
871	12.7	Cm
872	12.8	Ar
872	12.8	Hk
887	13.6	Bs
890	14.0	L
890	13.2	Cm
894	13.4	B
896	13.6	Bs

Variable Star Observations Received During April, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
W Pup			**R Cnc**			**RT Hya**			**S Hya**			**S Pyx**			**X Hya**		
074241			081112			*082405*			084803			*090024*			*093014*		
828	10.6	Ht	885	9.3	Sq	885	9.4	Hk	884	8.8	Hf	887	9.4	Jo	807	11.4	Ch
830	10.7	dK	885	9.1	Hk	887	8.9	Lt	885	8.8	Hk	889	9.4	Bm	836	10.2	Ch
837	10.4	dK	886	9.4	Kp	888	9.3	Hk	885	8.8	Cl	897	8.7	Jo	836	9.9	Bm
839	9.7	Ht	886	8.5	Hm	889	8.5	Bj	885	8.8	Ah	898	9.2	Bj	836	10.0	By
843	9.7	dK	887	9.7	Bs	889	9.3	Fn	887	7.8	Jo	899	8.5	Jo	842	9.8	Bm
849	9.4	dK	887	8.8	Md	890	9.0	Kn	888	9.3	Ra	**V UMa**			845	9.8	Ch
849	9.5	Ht	887	8.9	Sz	898	8.9	Lt	888	8.8	Hk	090151			853	9.7	Hf
856	9.2	dK	887	8.8	Jo	900	8.9	Jo	893	8.5	Jo	864	10.3	Cl	858	9.1	Bm
857	9.4	Ht	888	8.8	Hk	**R Cha**			895	9.5	Hf	867	10.3	Cl	859	9.1	Bj
857	9.0	En	888	9.0	Ra	*082476*			895	9.2	Md	887	10.8	Jo	862	9.3	Hf
861	9.1	En	888	8.4	Hm	828[	12.6	Ht	896	8.9	Jo	888	10.2	Cl	864	8.6	Cm
862	9.2	Ht	889	8.8	Hm	849[	12.4	Ht	896	9.7	Rb	888	10.3	Hf	864	9.2	Hk
866	9.4	En	889	8.7	Hm	857	12.6	Ht	897	9.2	Bj	893	10.6	Jo	870	9.3	Rb
T Gem			889	8.7	Bj	857	12.4	En	899	9.3	Jo	**W Cnc**			873	8.7	Hk
074323			891	8.7	Sq	862	12.4	Ht	902	9.8	Md	090425			884	8.7	Hb
809	9.5	Ch	891	8.9	Hm	866	12.0	En	**T Hya**			845	13.0	Ch	884	8.5	Sh
836	11.7	Ch	892	8.6	Jo	869	12.2	Ht	*085008*			868	13.4	B	884	8.7	Hf
841	10.8	Hf	892	8.6	Be	**U Cnc**			807	7.4	Ch	870	13.7	Bs	885	8.3	Hk
854	12.9	Hf	893	8.8	Md	083019			836	8.5	Ch	887	12.9	Bs	885	8.8	Rc
854	13.7	Ch	895	8.8	Sf	836	9.3	Ch	844	9.2	Hf	891	13.5	Wp	886	9.1	Hm
864	13.3	Ma	895	8.6	Hm	844	10.6	Hf	856	9.4	Ch	891	13.6	Wa	887	8.5	Dl
870	13.4	Cm	895	8.9	Hf	845	10.5	Ch	859	9.4	Bj	892	13.6	Be	888	8.7	Dl
872	13.0	Ar	896	8.7	Jo	856	10.9	Fc	862	9.3	Hf	896	13.7	Bs	888	8.7	Hm
872	13.1	Hk	896	8.5	Hm	862	11.1	Hf	864	9.9	Hu	**RW Car**			888	8.5	Hk
888	14.1	Ma	896	8.8	Bs	863	11.0	Br	864	9.8	Pb	*091868*			888	8.3	Gy
U Pup			896	8.8	Mi	864	11.4	Hk	864	9.8	Hk	828[	12.8	Ht	889	8.6	Dl
075612			898	8.6	Es	864	11.4	Cl	873	10.2	Hk	858[	12.8	En	889	8.5	Fn
843[	13.2	Ch	898	8.6	Md	865	11.4	Bj	884	10.6	Hf	862[	12.8	Ht	889	8.5	Bm
859[	13.2	Bj	899	8.7	Wd	870	11.9	Bs	885	10.7	Hk	869[	12.8	En	889	8.4	Jo
868[	12.5	Mi	899	8.5	Jo	887	12.5	Bs	888	10.7	Hk	**Y Vel**			889	8.7	Hm
898[	13.2	Bj	903	8.5	Md	888	12.3	Ma	889	11.0	Bs	*092551*			890	8.6	Dl
RV Cnc			906	8.6	Pt	888	12.1	Hk	896	11.0	Jo	828[	12.9	Ht	892	8.5	Jo
080319			**V Cnc**			892	12.2	Be	896	11.0	Hf	849[	12.9	Ht	893	8.4	Jo
863	11.9	Br	081617			896	13.1	Br	897	10.8	Bj	857[	12.9	En	895	8.6	Hf
891	12.0	Br	807	10.8	Ch	897	13.1	Bj	**T Cnc**			869[	12.9	En	895	8.8	Hm
SU UMa			845	12.5	Ch	**X UMa**			085120			**R Car**			896	8.6	Hm
080362			864	12.6	Hk	083350			836	10.5	Ch	*092062*			896	8.6	Rc
863[	13.8	Br	865	12.9	Bj	863	14.0	Br	844	10.1	Hf	809	4.7	Df	896	8.5	Jo
R Cnc			870	12.6	Bs	876[	12.5	Pb	845	10.2	Ch	813	5.0	Df	896	8.7	Dl
081112			883	12.3	Gy	**S Hya**			854	10.2	Ch	824	5.3	Df	898	8.2	Bj
807	10.6	Ch	887	12.6	Bs	084803			862	10.2	Hf	828	5.5	Ht	899	8.7	Dl
843	9.8	Ch	888	12.2	Gy	807	8.1	Ch	864	10.2	Hk	830	5.8	dK	899	8.6	Hm
844	10.2	Hf	888	11.9	Ra	836	7.8	Ch	864	10.2	Pb	836	5.7	Sl	900	8.7	Dl
862	9.7	Hf	889	12.1	Bj	844	8.0	Hf	887	8.8	Jo	837	5.9	dK	900	8.5	Cm
864	9.4	Hu	892	11.8	Be	856	7.9	Ch	888	10.2	Hf	839	6.3	Ht	900	8.6	Jo
864	9.4	Hk	893	11.7	Md	862	8.5	Hf	888	10.1	Hk	841	5.8	Sl	902	8.7	Pg
864	9.4	Pb	896	11.7	Bs	864	8.1	Dh	892	9.4	Be	843	6.1	dK	**Y Dra**		
865	9.8	Kp	898	11.7	Es	864	8.0	Hk	893	8.8	Jo	849	6.4	dK	093178		
865	8.9	Bj	898	11.7	Md	864	8.0	Pb	896	8.7	Jo	849	6.4	Ht	845	11.7	Ch
868	9.4	Mi	**RT Hya**			866	8.0	Fn	906	8.6	Pt	856	6.6	dK	856	10.0	Ch
870	10.1	Bs	*082405*			867	8.2	Bj	**S Pyx**			857	6.5	Ht	865	9.3	Hf
871	9.6	Kp	863	8.6	Cl	872	8.6	Ah	*090024*			857	6.4	En	870	9.1	Bs
879	9.0	Hm	864	8.9	Hk	873	8.5	Ah	836	12.6	Bm	860	6.7	Sl	888	9.1	Bs
883	9.3	Sz	865	8.7	Bj	873	8.3	Hk	845	12.0	Ch	862	7.1	Ht	889	9.4	Gy
884	9.0	Sf	866	8.9	Si	874	8.5	Ah	854	12.0	Bm	869	7.8	Ht	889	9.7	Hf
884	9.0	Sh	866	8.8	Fn	876	8.3	Cl	858	11.8	Bm	869	7.0	En	897	9.7	Jo
884	8.5	Wh	873	9.2	Hk	882	8.7	Ah	865	11.4	Bj				901	9.5	Bs
884	9.1	Hf	879	8.4	Cl	884	8.4	Sh	885	9.8	Hk						

Variable Star Observations Received During April, 1935.

R LMi
093934
807 12.0 Ch
843 12.0 Ch
866 10.6 Sq
870 12.2 Bs
870 11.9 Rb
883 11.9 Sz
887 11.0 Sz
888 11.4 Gy
888 10.6 Bs
888 11.2 Hk
890 10.6 Dl
891 11.1 Wa
895 10.6 Dl
900 10.6 Dl
903 11.0 Dt
906 10.4 Pt

RR Hya
094023
836 10.4 Bm
842 10.6 Bm
845 9.7 Ch
858 9.2 Bm
859 9.5 Bj
864 9.5 Dh
864 9.4 Hk
869 9.7 En
873 9.5 Hk
885 9.4 Hk
889 9.3 Bm
898 9.7 Bj

R Leo
094211
807 8.8 Ch
829 9.4 Ch
844 9.8 Hf
845 9.8 Ch
847 9.7 Kd
854 9.8 Hf
855 9.8 Pk
856 9.9 Ch
856 9.9 Kd
861 9.8 Ha
862 9.8 Hf
862 9.7 Kd
864 10.0 Dh
864 9.9 Hk
864 9.4 Pb
865 10.4 Kp
865 9.9 Ha
866 9.9 Ha
866 9.4 Pb
866 9.9 Si
866 9.8 Kd
866 9.2 Sq
867 9.3 Bj
868 9.5 Cm
868 10.2 Kd
869 9.8 Si

R Leo
094211
869 9.7 By
870 9.8 Bs
870 9.8 Rb
870 9.8 Kd
871 10.3 Kp
871 9.9 Hf
872 9.7 Je
872 9.1 Ah
873 9.2 Ah
873 9.5 Hk
873 9.3 Lf
873 9.3 Pb
874 9.2 Pb
874 9.1 Ah
877 9.6 Kd
879 8.8 Ba
882 9.4 Fs
883 8.9 Ah
884 9.5 Wp
884 8.9 Sq
884 9.7 Dl
884 9.4 Wa
884 9.7 Kd
885 9.8 Ha
885 9.0 Je
885 9.1 Ah
886 9.7 Kd
886 9.4 Ba
886 9.4 Wp
886 9.0 Je
886 9.0 Mc
886 9.6 Kg
886 9.6 Dl
886 9.4 Wa
886 9.6 Kp
886 8.9 Jo
886 9.6 Hf
886 9.9 Hm
887 8.9 Pb
887 9.6 Dt
887 9.6 Dl
888 9.7 Kd
888 9.0 Lf
888 9.0 Pg
888 9.3 Bk
888 9.3 Sf
888 9.0 Bs
888 9.6 Dl
888 9.1 Ma
888 9.9 Hm
889 9.1 Hk
889 8.9 Sz
890 9.4 Ha
891 9.2 Wp
891 9.3 Wa
891 9.5 Hm
895 9.1 Dl
895 9.6 Kd

R Leo
094211
895 9.6 Hm
896 9.3 Hm
896 9.2 Hf
896 8.8 Rb
896 9.1 Dl
896 8.9 Wa
896 9.3 Sf
897 8.8 Ba
897 9.1 Sh
897 8.7 Jo
897 9.0 Wa
898 8.8 Kd
899 9.1 Dl
899 9.1 Hm
899 9.0 Wd
900 9.3 Kd
900 8.8 Ba
901 9.0 Bs
902 8.2 Pg
906 7.5 Pt

1 Car
094262
795 4.1 Df
809 4.0 Df
813 4.0 Df
824 4.0 Df
837 3.1 Df
844 2.8 Df
854 4.2 En
857 4.3 En
858 4.3 En
864 4.2 En
866 4.0 En
869 3.5 En

Y Hya
094622
869 8.0 En

Z Vel
094953
828[12.8 Ht
849[12.1 Ht
857 12.8 Ht
862 12.9 Ht
869 12.4 En
869 12.9 Ht

V Leo
095421
868 13.6 B
870 13.6 Bs
883 12.9 Wu
887 12.9 B
888 13.9 Ma
891 12.6 Es
896 11.9 Sf
896 12.1 Rb
897 12.0 Jo
901 11.0 Bs

RR Cen
095458
828 7.8 Ht
839 7.9 Ht
849 7.9 Ht
857 8.1 Ht
862 8.0 Ht
869 8.0 Ht
869 8.0 En

RV Car
095563
828[13.1 Ht
849[13.1 Ht
857[13.1 Ht
869[13.1 En

S Car
100661
828 9.4 Ht
830 8.8 dK
837 8.9 dK
839 8.7 Ht
841 8.3 Sl
843 8.4 dK
849 7.7 dK
849 7.8 Ht
856 7.0 dK
857 7.5 Ht
858 7.0 En
860 6.7 Sl
862 6.9 Ht
869 6.9 Ht
869 7.0 En

U UMa
100860
851 6.5 Lt
865 6.5 Lt
874 6.4 Lt
890 6.5 Lt

Z Car
101058a
828 12.5 Ht
839 11.7 Ht
849 11.3 Ht
857 10.9 Ht
862 10.6 Ht
869 10.4 Ht
870 10.4 En

W Vel
101153
828[13.0 Ht
857[13.0 Ht
862[13.0 Ht
870[13.0 En

U Hya
103212
842 5.9 Kd
857 6.0 Kd
869 5.9 Kd
872 6.0 Kd
884 5.9 Kd

U Hya
103212
889 5.0 Si
895 6.0 Kd

RZ Car
103270
839 12.3 Ht
849 11.5 Ht
857 10.9 Ht
862 10.8 Ht
869 10.5 Ht
869 10.3 En

R UMa
103769
811 9.6 Ch
829 10.5 Ch
837 11.0 Ch
844 11.0 Hf
854 11.7 Hf
856 11.4 Fc
858 11.2 Ch
866 11.0 Sq
867 11.7 Cl
868 11.7 Cm
870 12.0 Bs
884 12.2 Wd
887 12.3 Hi
887 12.1 B
888 12.3 Bs
888 11.9 Cl
888 12.1 Gy
898 12.3 B
900 12.2 Cm
901 12.2 Bs
902 12.5 Pg
906 12.5 Pt

V Hya
104620
859 7.2 Ch
864 8.0 Hu
864 8.4 Hk
866 8.0 Si
867 7.3 Bj
869 8.2 Si
873 8.5 Hk
884 7.8 Jo
885 8.7 Hu
885 8.6 Hk
886 8.2 Rc
887 7.7 Jo
888 8.5 Hk
889 8.3 Fn
889 8.2 Hb
890 8.2 Kn
892 7.2 Be
892 7.6 Jo
896 7.7 Jo
900 7.5 Jo

RS Hya
104628
859 13.6 Bj
870[13.0 En

W Leo
104814
836 11.9 Bm
842 12.1 Bm
850 12.2 Bm
858 12.3 Ch
864 12.0 Wp
864 12.2 Wa
864 12.4 Bm
867 12.2 Bj
868 12.5 B
887 12.7 B
888 13.1 Ma
889 12.8 Bs
889 12.4 Bm
891 13.0 Es
896 12.7 Rb
901 13.0 Bs

RS Car
110361
866[12.3 En

S Leo
110506
858 11.8 Ch
867 12.4 Bj
873 12.2 Ar
873 12.3 Hk
873 12.4 Pb
874 12.4 Pb
887 13.1 B
896[12.5 Rb

RY Car
111561
828 11.1 Ht
839 11.0 Ht
849 11.0 Ht
857 11.2 Ht
862 11.8 Ht
866 12.0 En
869 12.1 En
869 12.4 Ht

RS Cen
111661
828 9.2 Ht
839 8.7 Ht
849 9.0 Ht
859 9.3 Ht
862 9.7 Ht
866 10.3 En
869 10.4 En
869 10.5 Ht

X Cen
114441
828 8.0 Ht
839 8.4 Ht
849 9.1 Ht

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
X CEN			R COM			R CRV			T CVN			T UMA			R VIR		
114441			115919			*121418*			122532			123160			123307		
857	9.1	Ht	888	8.8	Gy	889	7.6	Wa	901	10.5	Bs	896	9.0	Kg	906	7.9	Pt
862	9.6	Ht	888	8.7	Hk	892	8.0	Jo	906	10.5	Pt	896	9.3	Hf	RS UMA		
869	10.1	Ht	892	8.7	Jo	895	7.6	Kd	Y VIR			896	9.5	Dl	123459		
AD CEN			896	8.7	Hf	896	8.0	Wa	*122803*			898	9.2	B	811	11.5	Ch
114858			897	8.8	Jo	896	8.7	Mi	836	11.4	Bm	898	10.7	Wh	836	9.7	Bm
828	9.5	Ht	900	9.0	Jo	897	8.1	Ba	842	11.6	Bm	899	8.8	Dl	837	9.3	Ch
839	9.6	Ht	SU VIR			896	7.9	Jo	850	10.4	Bm	899	8.3	Jo	842	9.5	Bm
849	9.6	Ht	120012			898	7.6	Kd	860	9.9	Ch	899	8.8	Hm	849	9.3	Hf
857	9.7	Ht	859	13.3	Ch	899	7.8	Jo	862	9.4	Hf	900	8.8	Dl	850	9.5	Bm
862	9.4	Ht	888	13.4	B	900	7.8	Ba	864	9.9	Hk	901	8.9	Bs	859	9.2	Hf
869	9.3	Ht	888	13.8	Ma	900	8.1	Kd	864	9.9	Pb	902	8.7	Rc	860	9.2	Ch
W CEN			892	13.3	L	905	8.2	Bu	864	9.9	Ar	905	8.3	Rc	864	9.5	Bm
115058			906	12.0	Pt	RY UMA			864	10.0	Bm	905	8.0	Md	865	9.5	Ry
828	9.7	Ht	T VIR			121561			865	9.5	Bj	906	8.3	Pt	866	9.9	Sq
839	9.4	Ht	*120905*			857	7.7	Lt	866	10.0	Pb	906	8.4	Cm	868	9.4	Ry
849	8.5	Ht	864	14.0	Ar	865	7.7	Lt	870	9.5	Hf	R VIR			871	9.6	Bm
857	8.4	Ht	888	13.9	Bs	874	7.6	Lt	871	9.6	Bm	123307			871	9.3	Hf
862	8.4	Ht	892	14.1	L	887	7.5	Lt	880	8.9	Bm	837	8.0	Ch	872	9.9	Je
869	8.4	Ht	901	13.2	Bs	SS VIR			884	8.6	Jo	860	7.1	Ch	872	9.4	Ry
870	8.8	En	R CRV			122001			887	8.7	Jo	862	7.2	Hf	874	9.7	Ry
Z UMA			*121418*			856	8.2	Fc	888	9.2	Ma	864	7.4	Hk	877	10.3	Ry
115158			836	9.1	Bm	862	9.2	Hf	888	9.1	Hf	864	7.4	Pb	880	10.0	Bm
841	7.0	Hf	841	8.4	Sl	864	9.1	Hk	889	8.8	Bm	866	7.2	Fn	882	10.3	Ry
844	7.0	Hf	842	8.6	Bm	864	8.8	Pb	891	9.3	B	867	7.3	Ah	882	10.2	Es
845	7.0	Hf	842	8.6	Kd	870	9.0	Hf	893	8.6	Be	870	7.2	Hf	884	10.2	Wd
845	7.0	Rb	848	8.6	Kd	876	8.2	Cl	896	9.5	Jo	872	7.0	Ah	884	10.0	Dl
846	7.0	Rb	850	8.1	Bm	884	7.8	Jo	898	9.2	Bj	873	7.1	Ah	884	9.9	Jo
849	7.0	Hf	857	7.6	Kd	885	7.5	Cl	899	9.7	Jo	874	7.1	Ah	885	10.3	B
859	6.8	Hf	860	7.4	Sl	887	8.4	Pb	901	9.3	B	875	7.1	Ah	885	10.3	Sq
861	7.4	Rb	863	7.3	Kd	887	7.6	Jo	U CEN			877	7.4	Rc	886	10.2	Je
862	6.9	Hf	862	7.5	Hf	888	8.7	Hf	*122854*			878	7.2	Ah	886	10.0	Dl
865	6.9	Hf	864	7.7	Ar	889	8.2	Sz	828	8.2	Ht	883	7.3	Ah	887	10.1	Dl
865	7.5	Rb	864	7.4	Hk	891	7.8	B	839	8.5	Ht	885	7.3	Ah	887	10.0	Jo
865	6.9	Kp	864	7.7	Pb	892	7.4	Jo	849	8.5	Ht	886	7.6	Ba	888	10.3	Hf
870	7.6	Rb	865	7.2	Bj	893	7.6	Be	857	8.7	Ht	886	7.2	Rc	888	10.4	Ma
871	7.2	Kp	864	7.6	Bm	896	7.5	Jo	862	8.9	Ht	887	7.4	Rc	888	10.1	Dl
871	7.4	Hf	866	7.6	Pb	896	8.7	Mi	869	9.3	Ht	887	7.8	Pb	888	10.4	Gy
877	7.5	Hf	866	7.1	Kd	899	7.6	Jo	870	9.6	En	888	7.8	Ma	889	10.2	Bm
884	8.4	Hf	867	7.1	Kd	902	8.1	Md	T UMA			888	7.6	Hf	891	10.4	Ry
886	8.4	Hf	869	7.0	Kd	T CVN			123160			889	7.4	Si	892	10.2	Jo
886	8.3	Kp	870	7.5	Hf	122532			860	12.8	Ch	889	7.4	Fn	895	10.2	Dl
887	8.1	Rb	871	7.5	Bm	837	11.2	Ch	875	11.8	Ah	889	7.2	Jo	896	10.6	Dl
888	8.1	Rb	871	7.1	Kd	860	11.0	Ch	876	11.9	Pb	891	7.3	B	896	10.3	Jo
888	8.5	Hf	874	7.2	Kd	865	11.5	Hf	882	11.2	Fs	891	7.5	Rc	896	10.3	Hf
889	8.5	Bs	877	7.0	Kd	867	10.8	Bj	884	11.7	Wd	892	7.5	Jo	896	10.5	Kg
895	8.8	Hf	880	7.4	Bm	885	10.6	Rc	884	11.3	Jo	893	7.6	Rc	898	9.9	B
896	8.8	Hf	884	7.3	Kd	886	10.8	Jo	885	11.0	Ah	893	7.4	Be	899	10.3	Jo
901	8.8	Bs	885	8.3	Je	887	10.2	Pb	885	11.1	B	895	7.7	Rc	900	10.5	Dl
R COM			886	8.2	Je	887	10.5	Hi	887	10.8	Jo	896	7.4	Jo	906	11.7	Pt
115919			887	8.3	Jo	888	10.9	Gy	888	10.9	Hf	896	7.8	Mi	906	11.7	Cm
853	9.2	Hf	887	7.3	Kd	888	11.0	Hk	888	10.7	Gy	897	7.7	Ba	S UMA		
859	8.9	Ch	888	7.9	Hf	888	11.4	Bs	888	10.4	Sa	898	8.1	Rc	123961		
862	9.2	Hf	888	8.2	Wd	888	11.2	Hf	888	9.7	Ma	899	7.7	Jo	811	11.6	Ch
867	8.5	Bj	888	7.8	Ba	892	10.4	Jo	889	10.3	Sz	900	8.2	Ba	837	10.0	Ch
870	8.9	Hf	888	7.6	Hk	896	10.5	Jo	889	10.2	Bs	902	8.1	Pg	844	9.7	Ch
884	8.8	Jo	889	7.6	Bm	899	10.4	Jo	892	9.4	Jo	902	8.3	Rc	849	9.5	Hf
886	8.7	Hf	889	8.1	Hb	900	10.6	Bj	893	8.7	Jo	902	8.0	Dt	860	8.8	Ch
887	8.7	Jo	889	7.8	Wp	902	10.7	Md	895	9.2	Rc	905	8.6	Rc	862	8.6	Hf

Variable Star Observations Received During April, 1935.

J.D.	Est.	Obs.
S UMa		
123961		
866	8.6	Sq
871	8.2	Sa
871	8.3	Hf
872	8.6	Je
872	8.3	Ah
873	8.2	Ah
874	8.4	Ah
875	8.3	Ah
875	8.4	Fn
876	8.9	Pb
877	8.6	Dl
877	8.7	Hm
879	8.9	Hm
879	8.4	Dl
882	7.5	Fs
882	8.3	Ah
883	8.6	Wh
883	8.6	Dl
883	8.3	Ah
884	8.4	Wd
884	8.4	Dl
884	7.8	Jo
885	7.9	B
885	8.2	Rc
885	8.2	Sq
885	8.3	Ah
886	8.5	Sa
886	8.6	Je
886	8.3	Mc
886	8.5	Dl
886	8.6	Hf
886	8.4	Hm
887	8.4	Dl
887	7.9	Jo
888	8.7	Gy
888	8.2	Sa
888	8.4	Dl
888	8.2	Ma
888	8.5	Hm
889	8.4	Hm
889	8.1	Fn
889	8.2	Sz
892	7.8	Jo
893	8.0	Rc
895	8.3	Dl
895	8.3	Hm
896	8.3	Hm
896	7.8	Jo
896	8.4	Hf
896	8.4	Dl
896	7.9	Rc
896	8.4	Kg
898	7.8	B
899	8.4	Dl
899	7.9	Jo
899	8.4	Hm
902	8.4	Rc
905	8.2	Rc

J.D.	Est.	Obs.
S UMa		
123961		
906	7.8	Pt
906	8.2	Cm
RU Vir		
124204		
864	12.6	Ar
864	12.5	Pb
868	12.5	Bj
893	12.8	Be
906	[12.4	Pt
U Vir		
124606		
860	10.7	Ch
862	10.8	Hf
864	10.8	Hk
870	10.8	Hf
887	11.7	Hi
889	11.6	Bs
893	12.2	Be
901	12.1	B
901	12.2	Bs
902	12.2	Md
902	11.8	Pg
906	12.0	Pt
RV Vir		
130212		
860	11.5	Ch
864	11.6	Hk
864	11.6	Pb
888	13.0	Gy
893	12.9	Be
U Oct		
131283		
839	12.2	Ht
849	11.5	Ht
859	11.1	Ht
865	11.0	Ht
869	10.5	En
V CVn		
131546		
858	7.3	Lt
874	7.7	Lt
887	7.9	Lt
898	8.3	Lt
V Vir		
132202		
864	13.6	Ar
864	13.5	Hk
864	13.5	Pb
866	13.4	Pb
888	[13.2	Ma
R Hya		
132422		
808	9.5	Ch
829	9.0	dK
836	9.0	dK
839	9.2	Ht
842	8.8	dK
843	9.4	Ch

J.D.	Est.	Obs.
R Hya		
132422		
848	9.2	Kd
849	8.7	dK
849	9.2	Ht
854	8.8	Ch
855	8.5	dK
859	9.1	Ht
860	8.6	Ch
863	9.2	Kd
865	8.8	Ht
869	9.3	Kd
871	9.2	Kd
872	9.0	Kd
877	8.9	Kd
887	8.8	Kd
895	8.8	Kd
898	8.7	Kd
900	8.5	Kd
906	7.5	Pt
S Vir		
132706		
808	11.3	Ch
849	11.9	Ht
859	11.9	Ht
860	12.8	Ch
864	12.5	Pb
864	12.8	Ar
865	12.0	Ht
868	13.0	Bj
893	13.3	L
906	12.0	Pt
RV Cen		
133155		
839	9.8	Ht
849	9.8	Ht
857	9.5	Ht
862	9.7	Ht
869	9.5	Ht
T UMi		
133273		
885	14.3	Pf
T Cen		
133633		
839	6.2	Ht
848	6.3	Kd
849	5.9	Ht
859	5.9	Ht
860	6.0	Sl
865	6.0	Lt
865	6.0	Lt
865	5.9	Ht
869	6.3	Kd
871	6.2	Kd
887	6.9	Kd
898	7.7	Kd

J.D.	Est.	Obs.
RT Cen		
134236		
839	11.2	Ht
859	11.2	Ht
865	11.4	Ht
R CVn		
134440		
860	11.3	Ch
862	11.3	Hf
870	11.7	Hf
886	12.3	Jo
888	11.9	Hk
888	12.1	Hf
889	12.2	Bs
892	12.3	Jo
896	12.2	Jo
899	12.0	Jo
906	11.8	Pt
RX Cen		
134536		
839	[13.1	Ht
865	[13.1	Ht
T Aps		
134677		
839	12.1	Ht
859	13.1	Ht
865	[13.2	Ht
RR Vir		
135908		
864	13.8	Ar
888	12.9	Gy
906	11.5	Pt
Z Boo		
140113		
864	9.3	Hk
888	10.0	Hk
888	9.4	Ma
889	10.1	Gy
896	9.7	Jo
901	10.5	B
Z Vir		
140512		
864	12.4	Hk
864	12.4	Pb
870	12.7	Bj
RU Hya		
140528		
839	12.9	Ht
849	11.9	Ht
859	10.8	Ht
865	10.3	Ht
R Cen		
140959		
829	6.8	dK
836	6.3	dK
837	7.0	Df
839	6.3	Ht
841	6.2	Sl
843	6.2	dK
844	6.6	Df

J.D.	Est.	Obs.
R Cen		
140959		
849	6.2	Ht
849	6.2	dK
856	6.2	dK
857	6.1	Ht
860	6.2	Sl
862	6.2	Ht
869	6.2	Ht
U UMi		
141567		
849	9.2	Hf
862	9.7	Hf
866	10.0	Sq
871	9.9	Hf
872	10.6	Ah
873	10.7	Ah
874	10.6	Ah
875	10.5	Ah
884	10.4	Jo
885	10.7	Ah
885	10.5	Ra
887	10.8	Hi
888	10.7	Kn
888	11.0	Sf
888	10.9	Hf
889	10.5	Ma
889	10.7	Sz
891	11.0	Sq
892	10.6	Jo
896	10.6	Jo
896	11.2	Wa
896	11.1	Sf
899	10.8	Jo
906	11.4	Pt
S Boo		
141954		
808	11.8	Ch
813	10.9	Ch
846	9.6	Hf
860	8.8	Ch
862	9.0	Hf
864	9.0	Hu
864	8.7	Hk
864	8.7	Pb
864	8.6	Cl
870	8.5	Hf
883	8.5	Cl
884	8.4	Jo
885	8.2	Ra
887	8.1	Jo
888	8.2	Hf
889	8.1	Gy
892	8.1	Jo
896	8.2	Jo
899	8.2	Jo
902	8.4	Pg
906	8.1	Pt

J.D.	Est.	Obs.
RS Vir		
142205		
836	13.2	Bm
842	13.4	Bm
850	13.4	Bm
864	13.6	Ar
864	13.8	Bm
864	13.5	Pb
868	13.3	Bj
871	13.8	Bm
893	14.2	Bm
V Boo		
142539a		
813	7.8	Ch
854	8.9	Hf
860	9.2	Ch
862	9.1	Hf
864	8.8	Ar
864	8.9	Hk
870	9.2	Hf
872	8.8	Ah
873	8.9	Ah
874	8.8	Ah
877	9.4	Dl
878	8.9	Ah
879	9.3	Dl
883	9.3	Dl
884	9.2	Jo
885	9.5	Ar
885	9.4	Dh
886	9.1	Hm
887	9.3	Jo
887	9.4	Dl
888	9.5	Dl
888	9.5	Hk
888	9.3	Sf
888	9.5	Hf
888	9.3	Hm
889	9.5	Hm
890	9.2	Sq
891	9.4	Hm
892	9.5	Jo
895	9.5	Hm
895	9.7	Dl
896	9.6	Dl
896	9.2	Sf
896	9.4	Jo
896	9.4	Hm
899	9.5	Hm
899	9.6	Dl
900	9.6	Dl
906	9.0	Pt
R Cam		
142584		
829	8.8	Ch
843	9.1	Ch
856	9.4	Ch
871	9.8	Hf
888	10.7	Kn
888	10.7	Hf

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
R CAM			RT LIB			S UMI			R CRB			R CRB			R CRB		
142584			*150018*			153378			154428			154428			154428		
889	10.9	Gy	888	9.5	Hf	866	9.0	Sq	854	9.8	Ch	884	9.2	Kd	900	10.4	Cm
893	10.6	Jo	906	12.6	Pt	871	9.3	Kp	857	9.2	Kd	884	9.0	Wp	900	10.5	Dl
899	10.7	Jo	T LIB			871	8.9	Hf	863	8.9	Kd	884	9.2	Wa	902	10.3	Pg
R BOO			*150519*			875	8.8	Hm	863	8.4	Ar	884	9.7	Jo	902	9.7	Sx
143227			870[	13.0	Bj	877	8.6	Dl	863	8.7	Pb	885	9.2	Ah	903	10.4	Fa
813	8.6	Ch	906[	12.0	Pt	879	8.7	Dl	863	8.4	Dh	885	8.6	Dh	906	9.4	Pt
860	11.6	Ch	Y LIB			883	9.0	Dl	864	9.1	Hu	885	9.5	Je	X CRB		
862	11.6	Hf	*150605*			884	8.7	Dl	864	8.4	Ar	885	8.6	Ar	154536		
864	11.9	Hk	870	13.6	Bj	884	8.9	Sf	864	8.4	Pb	885	8.5	Hu	889	13.0	Ma
864	11.9	Pb	S LIB			884	8.7	Jo	864	8.4	Dh	885	8.7	Ra	906[	12.2	Pt
870	11.9	Hf	*151520*			885	9.3	Ra	864	8.6	Pb	886	9.4	Dl	R SER		
884	12.0	Jo	864	8.5	Hk	886	9.6	Kp	865	8.4	Ar	887	9.3	Kd	154615		
889	12.6	Bs	865	8.6	Lt	886	8.8	Hm	865	8.6	Hk	887	9.5	Gy	808	7.8	Ch
888	12.3	Hk	870	8.6	Hf	886	8.7	Dl	865	8.9	Kp	887	9.6	Dl	862	10.1	Hf
892	12.4	Jo	888	8.9	Hf	887	8.6	Jo	866	9.2	Fn	887	8.7	Ar	870	10.2	Hf
892	12.3	Jo	897	8.9	Jo	888	8.6	Hm	866	8.3	Pb	887	9.5	Jo	887	11.0	Jo
906	12.5	Pt	S SER			889	8.7	Hm	866	8.8	Hu	887	8.7	Pb	888	11.3	Hf
V LIB			151714			889	8.6	Dl	866	9.3	Si	888	9.3	Gy	892	11.3	Jo
143417			865	12.5	Hk	889	9.0	Gy	867	10.1	Kd	888	9.8	Hm	896	11.6	Jo
870[	13.1	Bj	889[	14.3	Ma	891	8.9	Wd	867	9.0	Ah	888	9.6	Dl	906	11.8	Pt
RW BOO			906	13.5	Pt	891	8.6	Sq	869	10.3	Kd	888	9.7	Hf	V CRB		
143632			S CRB			891	9.0	Hm	870	9.1	Hf	888	8.7	Ar	154639		
858	7.9	Lt	151731			892	8.6	Jo	870	9.3	Si	888	9.1	Rb	862	10.4	Hf
RY BOO			808	10.0	Ch	895	9.1	Hm	871	9.1	Kd	888	9.4	Ba	864	9.8	Cm
144523			843	10.8	Ch	895	8.7	Sf	871	9.1	Hf	888	8.8	Hk	870	10.6	Hf
858	7.4	Lt	862	11.5	Hf	896	9.0	Hm	872	9.0	Kd	888	8.6	Pb	887	9.4	Jo
S LUP			864	11.3	Ar	896	8.7	Dl	872	9.0	Ah	889	9.6	Hm	888	10.6	Hf
144646a			864	11.4	Pb	899	8.8	Dl	873	9.1	Ah	889	10.0	Rb	892	9.4	Jo
859	12.0	Ht	866	11.5	Pb	899	8.8	Hm	873	8.8	Hk	889	9.7	Cm	896	9.6	Jo
865	12.1	Ht	870	11.9	Hf	899	8.2	Jo	873	8.6	Pb	889	9.6	Gy	899	9.5	Jo
X LUP			885	11.9	Ra	906	8.7	Pt	873	8.6	Ar	889	9.2	Si	906	9.0	Pt
144646b			888	11.6	Ba	U LIB			874	8.4	Pb	889	9.0	Jo	R LIB		
865[	12.1	Ht	889	12.4	Bs	*153620a*			875	9.1	Ah	889	8.8	Pb	*154715*		
U BOO			906	12.4	Pt	847	13.4	Bj	875	8.9	Bk	889	8.7	Ar	864	10.9	Hk
144918			RS LIB			T NOR			876	8.9	Fa	889	9.4	Dl	870	10.7	Bj
864	12.5	Ar	*151822*			*153654*			876	9.2	Si	890	9.4	Rb	RR LIB		
864	12.5	Hk	849	11.2	Ht	839	8.8	Ht	876	8.7	Pb	891	9.6	Wp	*155018*		
885	11.6	Ar	865	12.0	Ht	849	8.7	Ht	876	8.8	Ar	891	9.6	Wa	906	12.0	Pt
887	12.4	Jo	RU LIB			859	8.5	Ht	877	9.2	Kd	892	10.0	Hu	RZ SCO		
888	11.6	Hk	*152714*			865	8.6	Ht	877	9.3	Dl	892	9.4	Jo	*155823*		
889	12.1	Gy	865	11.8	Hk	RR CRB			877	8.9	Dh	895	10.4	Kd	842	9.3	dK
896	12.0	Jo	870	11.6	Hf	153738			877	8.8	Ar	895	10.0	Dl	849	9.0	dK
Y LUP			888	10.2	Hf	857	7.9	Lt	877	9.0	Hk	896	10.0	Wa	849	9.3	Ht
145254			897	9.2	Jo	865	7.9	Lt	877	8.4	Pb	896	10.0	Rb	855	9.1	dK
839	10.8	Ht	906	8.9	Pt	873	8.0	Lt	877	8.8	Ar	896	10.2	Dl	865	9.3	Ht
849	10.1	Ht	R NOR			884	8.0	Lt	877	8.8	Dh	896	10.3	Wd	906	11.5	Pt
859	9.8	Ht	*152849*			898	8.0	Lt	878	9.1	Ah	896	9.8	Io	Z SCO		
865	9.5	Ht	839	7.5	Ht	R CRB			879	9.0	Wa	896	10.2	Fa	*160021*		
S APS			849	7.2	Ht	154428			879	9.0	Wp	897	10.4	Ba	865	11.6	Ht
145971			859	7.5	Ht	807	9.0	Ch	879	9.0	Lf	897	10.0	Hf	R HER		
839[	13.4	Ht	865	7.4	Ht	808	8.8	Ch	879	8.9	Ar	898	10.4	Kd	160118		
841[	13.4	Sl	S UMI			811	8.9	Ch	879	8.9	Dh	899	10.0	Hm	888	13.0	Gy
849[	12.5	Ht	153378			813	9.0	Ch	879	8.8	Pf	899	10.1	Dl	899	12.0	Jo
859[	13.4	Ht	841	10.2	Hf	822	11.2	Kd	879	9.6	Dl	899	9.6	Jo	906	10.2	Pt
RT LIB			843	10.0	Ch	842	11.4	Kd	882	8.9	Rb	899	10.0	Hf	U SER		
150018			854	9.7	Hf	843	11.0	Ch	883	9.1	Ah	900	10.2	Kd	160210		
864	10.9	Hk	864	9.6	Cm	848	10.3	Kd	883	8.8	Ar	900	9.5	Jo	862	10.6	Hf
870	10.9	Hf	865	9.2	Kp	853	10.0	Kd	883	9.4	Dl	900	10.4	Fa	865	11.3	Hk

Variable Star Observations Received During April, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
U Ser			V Oph			R UMi			RV Her			UW Dra			R Sct		
160210			*162112*			163172			165631			175554			*184205*		
870	11.4	Hf	899	8.4	Jo	891	9.4	Sq	887	11.3	Jo	857	7.5	Lt	843	6.1	Ch
889	13.0	Ma	906	8.2	Pt	892	9.5	Jo	896	11.0	Jo	873	7.5	Lt	848	5.9	Kd
906[	12.0	Pt	U Her			895	9.5	Dl	R Oph			884	7.3	Lt	863	6.6	Pb
SX Her			162119			896	9.6	Dl	*170215*			890	7.2	Lt	864	5.6	Ar
160325			862	10.9	Hf	899	9.5	Dl	864	9.1	Ar	898	7.5	Lt	873	5.6	Pb
862	7.9	Hf	864	11.0	Cm	899	9.5	Jo	873	8.5	Ar	R Pav			873	5.6	Ar
863	8.1	Lt	871	10.9	Hf	899	9.5	Hm	873	8.4	Pb	*180363*			874	5.4	Pb
870	8.2	Hf	872	12.0	Ah	900	9.8	Dl	877	7.9	Rc	849	11.5	Ht	876	5.5	Pb
887	8.5	Lt	875	10.5	Ah	R Dra			886	7.7	Rc	865	12.5	Ht	876	5.5	Ar
888	8.3	Hf	887	9.8	Jo	163266			887	7.4	Jo	T Her			876	5.8	Si
888	8.3	Gy	887	10.1	Dl	808	7.8	Ch	888	7.4	Gy	180531			877	5.6	Rc
892	8.5	Lt	888	9.9	Hf	843	9.3	Ch	892	7.0	Jo	843	8.0	Ch	879	5.7	Dl
896	8.2	Jo	888	9.7	Gy	862	10.0	Hf	895	7.2	Rc	874	9.8	Ah	883	5.5	Dl
897	8.2	Hf	888	10.1	Dl	865	10.2	Kp	896	7.1	Rc	888	11.7	Gy	884	5.6	Jo
897	8.8	Lt	889	10.0	Dl	871	10.2	Hf	897	7.2	Jo	889	12.6	Jo	886	5.7	Rc
899	8.4	Jo	889	9.4	Jo	884	11.5	Jo	898	7.0	Rc	W Dra			888	5.7	Gy
906	8.1	Pt	890	10.0	Dl	837	11.7	Jo	900	6.8	Jo	180565			888	5.1	Ma
RU Her			896	8.7	Jo	888	11.2	Gy	902	6.9	Rc	885	11.7	Pf	889	5.7	Jo
160625			899	8.8	Jo	888	11.1	Hf	Z Oph			X Dra			889	5.7	Dl
888	11.8	Gy	899	9.2	Hm	890	10.3	Ma	171401			180666			890	5.9	Ma
890	11.7	Ma	899	9.2	Dl	891	11.4	Wd	864	12.5	Cm	885[	13.4	Pf	895	5.6	Rc
896	11.6	Jo	900	9.0	Dl	892	11.9	Jo	906	9.9	Cm	Nov Oph			896	5.7	Jo
897	11.4	Hf	902	8.4	Pg	899	12.0	Jo	RS Her			180911			898	5.7	Rc
899	11.5	Jo	906	7.5	Pt	906	12.0	Pt	171723			864	13.1	Ar	898	5.6	Kd
902	10.6	Pg	g Her			RR Oph			845	9.4	Bj	RY Oph			899	5.5	Jo
906	10.5	Pt	162542			*164319*			S Oct			181103			902	5.8	Rc
R Sco			850	4.8	Lt	836	14.3	Bm	*172486*			889	8.5	Cl	906	6.7	Pt
161122a			863	5.1	Lt	842	14.5	Bm	832	9.9	dK	899	8.7	Lt	906	6.9	Cm
836	13.2	Bm	884	4.9	Lt	864	14.9	Bm	837	10.0	dK	W Lyr			RW Lyr		
842	12.3	Bm	898	4.9	Lt	871	14.8	Bm	839	10.5	Ht	181136			184243		
850	11.5	Bm	903	4.6	Lt	893	13.7	Bm	843	10.5	dK	887	10.0	Jo	876	12.0	Ar
864	10.6	Bm	SS Her			S Her			849	11.0	dK	888	10.4	Hf	Nov Aql		
870	10.5	Bj	162807			164715			849	11.2	Ht	889	10.2	Jo	184300		
871	10.6	Bm	884	9.5	Jo	813	9.5	Ch	856	11.2	dK	896	10.0	Jo	863	10.8	Pb
865	10.2	Ht	889	9.8	Jo	864	11.6	Cm	859	11.9	Ht	906	9.3	Cm	864	10.8	Pb
880	10.4	Bm	896	9.7	Jo	887	12.5	Jo	865	12.1	Ht	d Ser			864	11.1	Ar
893	10.7	Bm	899	10.0	Jo	899	12.5	Jo	RU Oph			182200			873	10.7	Ar
906	10.5	Pt	902	9.6	Pg	906[	12.0	Cm	172809			865	5.3	Lt	873	10.8	Pb
S Sco			906	9.9	Pt	RS Sco			888	9.5	Gy	899	5.1	Lt	874	10.9	Pb
161122b			W Her			*164844*			890	10.4	Ma	T Ser			876	11.3	Pb
842	14.7	Bm	163137			842	9.6	dK	W Pav			182306			876	11.3	Ar
864	14.0	Bm	885	11.5	Dh	849	10.0	dK	*174162*			899	9.7	Jo	888	10.9	Gy
871	13.8	Bm	889	10.6	Ma	849	10.5	Ht	865[	13.0	Ht	X Oph			890	10.8	Ma
880	13.3	Bm	896	10.7	Jo	855	10.4	dK	RS Oph			183308			899	11.3	Jo
906	11.6	Pt	899	10.4	Jo	865	10.8	Ht	*174406*			877	7.5	Rc	906	11.6	Pt
W CrB			906	10.2	Cm	RR Sco			888	10.8	Gy	884	7.7	Jo	S Sct		
161138			906	10.1	Pt	*165030a*			890	10.4	Ma	886	7.6	Rc	*184408*		
864	14.0	Ar	R UMi			843	6.3	dK	906	11.1	Pt	889	7.8	Jo	865	7.3	Lt
899	12.5	Jo	163172			849	6.2	dK	U Ara			895	8.0	Rc	899	7.4	Lt
906	11.8	Pt	862	9.7	Hf	849	6.2	Ht	*174551*			897	7.6	Jo	RX Lyr		
W Oph			866	9.4	Sq	851	6.4	dK	865	10.6	Ht	899	7.5	Jo	185032		
161607			871	9.6	Hf	865	6.9	Ht	T Dra			RY Lyr			864	14.5	Ar
854	11.2	Bs	884	9.7	Jo	SS Oph			175458a			184134			873	14.8	Ar
906[	12.0	Pt	887	9.6	Jo	*165202*			888	10.7	Hf	887[	12.0	Pb	876	14.7	Ar
V Oph			887	9.8	Dl	888[	12.5	Gy	RY Her			R Sct			887[	13.0	Pb
162112			888	9.8	Dl	RV Her			175519			*184205*			ST Sgr		
875	8.3	Si	888	9.7	Hf	165631			890	9.6	Ma	764	5.6	Hr	*185512a*		
892	8.2	Jo	889	9.8	Dl	885	11.5	Pf				780	5.9	Hr	890	11.9	Ma

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
R AQL			UX DRA			RT CYG			RS AQL			WX CYG			U DEL		
190108			192576			194048			*195308*			201437b			204017		
874	6.9	Ah	858	7.1	Lt	872	8.2	Ah	848	11.8	Bj	848	10.2	Bj	865	7.0	Lt
875	6.9	Ah	890	6.8	Lt	873	8.3	Ah	Nov CYG			864	11.3	Ar	899	6.9	Lt
875	7.5	Si	AF CYG			874	8.3	Ah	195553			873	11.3	Ar	W AQR		
883	7.1	Ah	192745			875	8.3	Ah	864	13.6	Ar	876	11.3	Ar	*204104*		
893	7.7	Jo	848	6.9	Kd	883	8.5	Ah	873	13.6	Ar	876	11.6	Pb	871[	13.0	Bm
899	7.9	Jo	871	7 ?	Kd	884	8.2	Jo	Z CYG			889	12.5	Jo	880[	13.4	Bm
TY AQL			872	7.2	Ah	888	8.5	Hf	195849			906	12.2	Cm	893	14.2	Bm
190907			873	7.2	Ah	888	8.4	Ma	804[	11.5	Ch	V SGE			T AQR		
847	10.7	Bj	874	7.1	Ah	888	8.8	Gy	887	10.5	Jo	201520			*204405*		
864	11.0	Ar	875	7.1	Ah	889	8.8	Dl	888	10.7	Hf	864	12.0	Ar	866	10.0	Cm
864	9.6	Dh	883	7.1	Ah	889	8.4	Jo	889	10.4	Io	U CYG			906	12.9	Cm
873	10.6	Ar	898	7.0	Kd	890	8.9	Cm	896	9.6	Jo	201647			R VUL		
873	10.6	Pb	TY CYG			896	8.9	Jo	S CYG			804	7.8	Ch	*205923a*		
876	10.9	Ar	192928			TU CYG			200357			841	8.7	Hf	804	10.3	Ch
888	10.5	Ma	804	11.0	Ch	194348			804[	11.4	Ch	846	8.4	Ch	TW CYG		
RS LYR			843	9.8	Ch	804	11.5	Ch	S AQL			847	7.9	Bj	210129		
190933a			854	9.5	Ch	811	10.9	Ch	*200715a*			864	9.6	Cm	880	10.2	Bm
888[	12.7	Gy	888	10.3	Gy	854	9.6	Ch	889	9.7	Jo	872	9.5	Ah	893	9.4	Bm
RU LYR			RT AQL			866	9.5	Ry	899	9.4	Jo	873	9.6	Ar	X CEP		
190941			193311			871	9.6	Ry	RW AQL			873	9.6	Pb	210382		
888	12.3	Gy	888	9.2	Ma	873	9.8	Ry	*200715b*			874	9.4	Ah	807	12.2	Ch
U DRA			R CYG			875	9.8	Ry	889	9.4	Jo	875	9.4	Ah	860[	12.1	Ch
190967			193449			877	9.9	Ry	899	9.5	Jo	876	9.7	Si	T CEP		
854	9.5	Ch	804	11.5	Ch	887	11.0	Jo	RU AQL			879	10.0	Dl	210868		
883	9.5	Pf	811	10.9	Ch	888	10.6	Hf	200812			883	9.6	Ah	804	8.1	Ch
885	9.5	Pf	846	9.4	Ch	888	10.2	Ma	888	9.4	Ma	887	9.7	Jo	811	7.5	Ch
888	9.9	Hf	854	8.7	Ch	888	10.5	Gy	Z AQL			888	9.8	Hf	841	8.1	Hf
888	9.7	Gy	864	8.8	Ar	889	11.5	Jo	*200906*			889	9.6	Jo	846	8.1	Ch
W AQL			864	7.9	Cm	890	10.5	Cm	871	13.0	Bm	889	10.0	Dl	854	7.3	Pk
191007			864	8.9	Pb	χ CYG			880	13.5	Bm	889	9.8	Si	865	7.8	Kp
847	9.0	Bj	872	7.5	Ah	194632			893	14.4	Bm	906	9.8	Cm	869	7.9	Si
864	10.9	Dh	873	7.6	Ah	804	7.0	Ch	R SGE			RU CAP			871	7.9	Kp
864	9.6	Ar	873	8.3	Ar	813	5.7	Ch	200916			*202622*			872	6.9	Ah
873	9.7	Ar	873	8.3	Pb	846	5.3	Ch	889	9.4	Jo	871	13.2	Bm	873	7.1	Ah
873	9.7	Pb	874	7.4	Ah	847	4.8	Bj	899	9.3	Jo	880	13.5	Bm	874	6.9	Ah
876	9.8	Ar	875	7.4	Ah	848	5.4	Kd	RS CYG			893	13.2	Bm	875	6.6	Ah
888	10.5	Ma	883	7.0	Ah	866	5.3	Cm	*200938*			Z DEL			877	7.7	Dl
R SGR			884	7.4	Jo	870	6.6	Hf	804	8.9	Ch	*202817*			878	6.7	Ah
191019			888	7.5	Hf	871	6.5	Kd	844	9.0	Ch	873	12.7	Ar	879	7.8	Dl
848	9.5	Bj	888	6.9	Ma	873	5.9	Ah	848	8.8	Bj	888[	13.1	Ma	879	7.2	Hm
RY SGR			888	7.7	Gy	874	5.9	Ah	854	9.2	Ch	ST CYG			882	6.6	Ah
191033			889	8.3	Dl	875	5.9	Ah	864	9.3	Ar	*202954*			883	6.5	Ah
850	7.7	Ht	889	7.4	Jo	879	6.1	Dl	873	9.2	Ar	889	11.5	Gy	884	7.3	Dl
906	7.5	Pt	890	7.4	Cm	883	6.4	Dl	876	9.1	Ar	S DEL			884	7.0	Hm
TZ CYG			896	7.6	Jo	883	6.2	Ah	876	9.1	Pb	*203816*			885	6.5	Ah
191350			TT CYG			884	6.9	Jo	876	8.9	Si	889	9.2	Jo	886	6.1	Ba
864	10.6	Ar	193732			888	6.7	Hf	887	8.7	Pb	V CYG			886	7.4	Dl
873	10.0	Ar	860	8.0	Lt	888	7.1	Ma	888	8.8	Hf	*203847*			886	6.9	Kp
873	9.8	Pb	892	8.2	Lt	889	7.0	Jo	889	7.8	Jo	811	13.5	Ch	886	6.3	Rb
876	10.2	Pb	899	8.1	Lt	890	6.5	Dl	889	8.6	Si	864	12.2	Ar	886	6.9	Hm
876	10.1	Ar	T PAV			893	6.8	Jo	906	8.4	Cm	888	11.7	Ma	887	7.2	Dl
888	9.9	Gy	*193972*			898	7.9	Kd	R DEL			Y AQR			887	6.7	Jo
889	10.4	Jo	865[	13.2	Ht	899	7.0	Jo	201008			*203905*			888	7.2	Dl
896	10.7	Jo	RT CYG			902	7.2	Pg	848	10.5	Bj	871	9.8	Bm	888	6.3	Ra
U LYR			194048			906	7.2	Cm	WX CYG			880	9.8	Bm	888	6.8	Hm
191637			804	10.8	Ch	RR AQL			201437b			893	10.8	Bm	889	6.8	Hm
889	11.0	Si	846	8.0	Ch	*195202*			804	9.5	Ch				891	6.6	Hm
889	11.5	Jo	864	8.1	Cm	847[	11.8	Bj	813	9.6	Ch				892	6.4	Jo

Variable Star Observations Received During April, 1935.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
T Cep			S Cep			TW Peg			R Peg			V Phe			V Cep		
210868			213678			215927			230110			*232746*			235182		
895	6.4	Dl	888	11.1	Kn	865	8.3	Lt	809	11.2	Ch	827[	12.7	En	867	6.4	Lt
895	6.5	Hm	892	10.3	Jo	899	8.2	Lt	V Cas			Z And			874	6.5	Lt
896	6.4	Dl	897	11.2	Ba	S Gru			230759			232848			887	6.5	Lt
896	6.5	Hm	899	10.5	Jo	*221948*			807	8.4	Ch	809	10.8	Ch	V Cet		
897	6.4	Ba	RU Cyg			830	10.5	dK	841	8.1	Hf	841	10.6	Hf	*235209*		
897	6.4	Hf	213753			RV Peg			865	8.5	Hf	862	10.6	Md	810	11.0	Ch
899	6.3	Dl	868	8.0	Ry	222129			869	8.9	Si	864	10.8	Ar	R Tuc		
899	6.0	Jo	873	7.9	Ry	809[	13.5	Ch	872	8.6	Ah	864	10.7	Pb	*235265*		
899	6.4	Hm	886	8.1	Ry	S Lac			873	8.7	Ah	864	10.7	Fr	828[	13.5	Ht
900	6.4	Hm	889	8.0	Jo	222439			874	8.7	Ah	864	10.6	Hk	849[	12.6	Ht
900	6.4	Ba	896	8.2	Jo	841	9.9	Hf	875	8.8	Ah	869	10.7	Md	857[	13.0	Ht
906	5.8	Cm	899	8.4	Jo	R Ind			875	8.7	Fn	ST And			869[	13.0	Ht
Y Pav			RR Peg			*222867*			883	9.0	Ah	233335			R Cas		
211570			214024			828[	13.5	Ht	886	9.5	Jo	809	8.8	Ch	235350		
828	6.0	Ht	810	12.9	Ch	839[	13.5	Ht	888	9.6	Pg	841	9.2	Hf	807	9.0	Ch
839	6.0	Ht	μ Cee			W Cep			892	9.4	Jo	R Aqr			829	9.8	Ch
849	6.0	Ht	214058			*223257*			896	9.7	Jo	*233815*			841	9.9	Hf
W Cyg			846	4.0	Lt	858	8.4	Lt	899	9.5	Jo	809	10.9	Ch	865	10.3	Hf
213244			865	4.1	Lt	865	8.5	Lt	W Peg			829	11.0	Ch	865	10.5	Kp
841	6.0	Kd	899	4.0	Lt	887	8.4	Lt	231425			Z Cas			Z Peg		
848	6.0	Kd	μ Cep			T Tuc			809	9.7	Ch	233956			235525		
871	7.2	Kd	215363			*223462*			841	9.1	Hf	810[	13.5	Ch	810	10.7	Ch
898	6.0	Kd	859	5.5	Lt	828	12.5	Ht	S Peg			899[	12.1	Jo	W Cet		
S Cep			874	5.5	Lt	839	11.1	Ht	231508			RR Cas			*235715*		
213678			890	5.4	Lt	R Lac			809	11.3	Ch	235053			810[	13.7	Ch
804	10.1	Ch	V Peg			*223841*			RY Cep			810[	13.3	Ch	Y Cas		
829	10.8	Ch	215605			809	12.9	Ch	231878			843[	12.5	B	235855		
860	11.2	Ch	810	13.2	Ch	RW Peg			804	9.2	Ch	V Cep			810[	13.3	Ch
886	11.0	Ba				225914						235182			SV And		
887	10.2	Jo				809	13.3	Ch				858	6.4	Lt	235939		
															810	13.3	Ch

Rapidly Varying Irregular Variables.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
005840 RX Andromedae—							060547 SS Aurigae—						
	7810.1	11.7	Ch	7864.3	12.1	Be		7872.1	10.7	Bm	7878.6	11.5	Hi
	7842.1	12.7	Ch	7868.4	11.2	Ry		7872.4	10.8	Ry	7879.6	11.8	Pf
	7844.1	11.1	Ch	7872.3	12.2	Ry		7872.6	11.0	Hi	7879.6	11.7	Wp
	7851.2[	11.3	Fc	7874.4[	11.3	Ry		7872.6	10.9	Ar	7879.6	11.6	Wa
	7854.1	12.9	Ch	7886.3	11.6	Ry		7873.1	10.6	Bm	7879.7	12.0	Ar
	7858.1	11.0	Ch	7887.5	12.0	Gy		7873.4	10.7	Ry	7879.7	11.9	Hi
	7863.7	12.9	Br	7888.5	12.1	Gy		7873.6	10.7	Ar	7880.6	12.4	Pf
020356 UV Persei—								7873.7	10.8	Hi	7881.7	13.1	Hi
	7863.7[	13.7	Br	7891.6[	13.7	Br		7874.2	10.9	Bm	7882.7	14.0	Hi
	7887.6[	13.5	Gy					7874.4	10.7	Ry	7883.6	14.3	Hi
060547 SS Aurigae—								7874.6	10.8	Hi	7883.7	14.2	Pf
	7809.1[	13.0	Ch	7863.8	14.8	Br		7875.5	10.8	Ry	7884.6	14.1	Wa
	7811.1[	13.8	Ch	7864.5	14.7	Ar		7875.7	10.8	Hi	7884.6	14.1	Wp
	7813.1	11.0	Ch	7865.4[	12.5	Ry		7876.4	10.8	Ry	7884.7[	14.5	Hi
	7816.1	12.2	Ch	7866.7[	13.9	Hi		7876.5	11.2	Wp	7885.1	14.1	Bm
	7837.1[	12.5	Ch	7868.4[	13.0	Ry		7876.5	11.0	Wa	7885.6	14.1	Ar
	7839.1	14.5	Bm	7869.1	13.8	Bm		7876.6	11.0	Hi	7886.5	14.6	Wa
	7846.1[	13.2	Bm	7869.5	12.9	Ry		7876.7	10.9	Pf	7886.6	14.5	Wp
	7854.1	14.9	Bm	7869.6	12.4	Hi		7877.4	11.1	Ry	7887.6[	13.9	Gy
	7856.1[	14.8	Bm	7870.5	10.8	Ry		7877.6	11.3	Ar	7887.7	13.8	Ar
	7858.1	14.9	Bm	7870.8	10.8	Hi		7877.6	11.0	Hi	7888.6	14.5	Wp
	7860.2[	13.8	Ch	7871.4	10.8	Ry		7878.6	11.6	Wa	7889.1	13.2	Bm
	7863.6[	13.9	Hi	7871.6	11.0	Hi		7878.6	11.6	Wp	7889.6	14.3	Wp

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
060547 SS AURIGAE—						
	7889.6	14.4	Wa	7895.6	[14.7	Wa
	7890.6	13.8	Ar	7896.6	14.5	Wp
	7890.7	[14.5	Pf	7896.6	14.4	Wa
	7891.6	14.6	Wp	7897.6	[13.9	B
	7891.6	14.7	Wa	7898.6	[13.2	Bj
	7894.6	[14.0	B	7906.7	[12.5	Pt
074922 U GEMINORUM—						
	7804.1	10.0	Ch	7887.6	9.8	B
	7810.2	14.0	Ch	7887.6	10.5	Wu
	7822.1	[12.2	Ch	7887.6	9.8	Gy
	7830.1	[13.3	Ch	7887.6	9.7	Bs
	7836.4	14.3	Bm	7887.7	9.8	Ar
	7839.1	14.4	Bm	7887.7	10.4	Pt
	7841.0	[12.4	Sl	7887.9	10.7	Kd
	7842.1	13.9	Kd	7888.5	10.7	Ie
	7843.1	[13.3	Ch	7888.6	10.6	Gy
	7845.1	13.8	Ch	7888.6	10.5	Ar
	7846.1	[13.7	Bm	7888.6	10.1	B
	7854.1	14.0	Bm	7888.6	10.5	Hf
	7854.1	14.0	Ch	7888.6	10.6	Pb
	7856.1	[13.7	Bm	7888.6	10.7	Wp
	7857.0	[13.9	Kd	7888.7	10.0	Ma
	7858.1	14.0	Ch	7888.7	10.4	Wd
	7858.1	14.4	Bm	7889.1	11.1	Bm
	7860.0	[12.4	Sl	7889.6	11.7	Wp
	7863.8	13.0	Ar	7889.6	12.1	Gy
	7864.7	14.0	Ar	7889.6	11.7	Wa
	7864.8	13.8	Ma	7889.6	11.9	Rb
	7868	[12.5	Mi	7889.6	11.1	Hf
	7869.1	14.0	Bm	7889.7	11.6	Bj
	7871.1	14.2	Bm	7889.8	11.3	Ar
	7871.7	14.0	Wu	7890.5	12.8	Cm
	7872.6	14.0	Ar	7890.6	12.5	Rb
	7873.6	13.7	Ar	7890.6	12.2	Ar
	7877.6	9.8	Ar	7890.7	12.5	Wu
	7877.8	9.7	Ar	7890.7	12.4	Ma
	7879.6	9.2	Wp	7891.6	13.0	Wp
	7879.6	9.0	Wa	7891.6	13.1	Wa
	7883.6	10.3	Wu	7891.6	12.9	Ie
	7883.7	9.4	Ar	7891.6	13.0	B
	7884.6	9.2	Wa	7891.7	[13.3	Cm
	7884.6	9.5	Sh	7891.7	13.4	Br
	7884.6	9.5	Hf	7891.7	13.5	Es
	7884.6	9.2	Wp	7892.4	13.5	L
	7885.1	9.6	Bm	7894.6	14.0	B
	7885.6	9.6	Ar	7895.0	[13.7	Kd
	7885.6	9.7	B	7896.6	14.0	Wa
	7886.5	9.9	Hf	7896.6	14.1	Wp
	7886.6	9 5	Wp	7897.6	14.0	B
	7886.6	10.9	Wu	7899.6	[12.3	Hf
	7886.6	9.5	Wa	7900.5	[13.8	Cm
	7887.0	9.7	Kd	7906.7	[12.4	Pt
081473 Z CAMELOPARDALIS—						
	7804.1	12.0	Ch	7864.7	10.4	Ar
	7822.1	11.2	Ch	7865.4	11.2	Ry
	7843.1	11.5	Ch	7866.6	11.2	Ry
	7854.1	13.1	Ch	7868.5	11.5	Ry
	7863.7	11.1	Br	7869.5	11.5	Ry
	7863.8	10.8	Md	7869.7	11.1	Md
081473 Z CAMELOPARDALIS—						
	7870.5	11.6	Ry	7886.6	12.9	Wa
	7871.4	11.9	Ry	7887.6	12.5	Gy
	7871.8	11.7	Md	7887.7	12.9	Ar
	7872.4	12.1	Ry	7887.7	12.6	Jo
	7872.6	11.7	Ar	7887.8	12.5	Md
	7873.4	12.3	Ry	7888.6	10.4	Pb
	7873.6	12.1	Ar	7888.6	11.1	Wp
	7874.4	12.6	Ry	7888.6	10.5	Ar
	7875.5	[11.9	Ry	7888.7	11.1	Gy
	7876.4	[12.2	Ry	7889.5	11.2	Ry
	7876.5	12.9	Wp	7889.6	11.4	Gy
	7877.4	[11.9	Ry	7889.6	10.9	Wa
	7877.6	12.2	Ar	7889.6	11.2	Hf
	7878.6	12.8	Wa	7889.6	10.8	Wp
	7879.6	13.0	Wp	7889.8	10.8	Ar
	7879.6	12.8	Wa	7890.6	10.4	Ar
	7879.7	13.2	Ar	7891.6	10.9	Wa
	7881.4	[11.9	Ry	7891.6	10.5	Ry
	7882.4	[11.9	Ry	7891.6	10.9	Wp
	7883.8	12.6	Ar	7893.7	12.5	Jo
	7884.6	13.1	Wp	7895.7	11.9	Md
	7884.6	13.0	Wa	7896.6	12.0	Wa
	7885.6	13.2	Ar	7896.6	12.1	Hf
	7886.3	13.3	Ry	7896.6	12.1	Wp
	7886.6	13.0	Wp	7899.9	12.5	Jo
094512 X LEONIS—						
	7845.2	12.5	Ch	7887.6	[12.6	Gy
	7863.8	[13.5	Br	7888.6	[13.5	Ar
	7864.7	[13.5	Ar	7889.6	[14.8	Wa
	7872.7	[13.5	Ar	7889.8	14.3	Ar
	7873.6	[13.5	Ar	7890.6	13.8	Ar
	7885.6	[13.5	Ar	7891.6	13.0	B
	7886.6	[14.2	Wa	7891.6	[14.2	Wa
180445 NOVA HERCULIS—						
	7792.5	1.8	Wn	7821.5	2.8	Y
	7794.9	1.8	Wn	7825.4	2.0	Ch
	7796.5	1.8	Wn	7827.5	2.4	Ma
	7797.5	2.8	Wn	7827.5	2.5	Y
	7798.9	2.8	Wn	7827.5	2.1	Ch
	7799.5	2.8	Wn	7827.9	1.8	Wn
	7802.4	2.6	Y	7829.5	2.1	Ch
	7802.5	2.3	Wn	7829.9	2.2	Y
	7802.9	2.8	Wn	7830.9	2.3	Wn
	7802.9	2.3	Y	7830.9	2.2	Y
	7803.4	2.6	Y	7831.5	2.3	Ch
	7804.5	2.8	Wn	7832.9	2.8	Wn
	7805.0	2.4	Y	7832.9	3.1	Y
	7806.0	2.4	Y	7834.5	2.5	Ch
	7806.5	2.6	Y	7834.9	2.9	Y
	7806.9	2.8	Wn	7836.8	2.9	Ar
	7807.0	2.4	Y	7836.9	2.8	Ar
	7807.9	2.8	Wn	7838.5	2.7	Ch
	7808.5	2.3	Y	7840.0	2.4	Rd
	7813.5	2.8	Wn	7840.8	2.8	Wn
	7813.9	2.4	Y	7842.2	2.1	Kd
	7813.9	2.8	Wn	7842.5	2.5	Ch
	7815.5	2.2	Y	7844.4	2.5	Ch
	7819.9	2.8	Wn	7845.0	3.0	Rd
	7821.5	2.0	Ch	7845.9	2.8	Wn

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
180445	Nova Herculis—						180445	Nova Herculis—					
	7846.5	2.7	Ch	7862.4	3.5	Ks		7868.6	2.6	Ah	7875.7	4.2	Pb
	7846.9	3.2	Wn	7862.5	3.4	Ap		7869.1	3.3	Kd	7875.6	3.9	Hm
	7846.9	3.1	Ha	7862.7	3.5	SA		7869.7	3.5	Si	7875.7	4.0	Kp
	7848.3	3.0	Kd	7862.7	3.4	Wk		7869.7	3.7	Hx	7875.6	4.0	Ah
	7849.2	3.3	Kd	7862.7	3.2	Rd		7869.8	3.6	Fn	7875.8	4.3	Fr
	7852.4	3.1	Ch	7862.8	3.9	Pq		7869.8	3.5	Si	7875.8	3.8	Pq
	7853.2	3.2	Kd	7862.8	3.9	Lz		7870.1	3.2	Kd	7875.8	3.8	Wk
	7853.5	3.2	Ap	7862.8	3.0	Ma		7870.7	3.9	SA	7875.8	3.9	Ms
	7853.7	3.9	Hx	7863.1	3.2	Kd		7870.7	3.9	Hf	7875.8	3.6	Ok
	7853.7	3.5	SI	7863.5	3.5	Ap		7870.7	3.8	Rd	7875.8	3.7	Hv
	7853.7	3.3	Pg	7863.7	3.6	Ks		7870.8	3.7	Ms	7875.9	3.8	Si
	7853.7	3.2	Wq	7863.8	3.6	Dh		7870.8	3.7	Ma	7875.9	3.9	Bk
	7853.8	3.7	Lz	7863.8	3.9	Ar		7870.8	3.7	Wk	7875.9	3.8	Fn
	7854.0	3.2	Ar	7863.8	3.6	Pm		7870.8	3.7	Gn	7876.0	3.7	Fn
	7854.5	3.2	Ap	7863.8	3.4	Pb		7870.8	3.7	Kp	7876.0	3.8	Si
	7854.8	3.5	Ms	7863.9	3.7	Hk		7870.9	3.6	Fn	7876.4	4.1	Ah
	7855.2	3.0	Kd	7863.9	3.5	Fn		7871.0	3.6	Fn	7876.5	4.0	Ah
	7855.4	3.8	Fc	7864.7	3.9	Ar		7871.2	3.4	Kd	7876.7	4.0	Hk
	7855.5	3.6	Ch	7864.7	3.9	Dh		7871.5	3.5	Ah	7876.7	3.9	Wa
	7855.5	3.4	Ap	7864.7	3.8	Rd		7871.5	3.7	Ap	7876.7	4.1	Hu
	7856.4	3.1	Ks	7864.7	3.8	Lf		7871.6	3.5	Ks	7876.7	4.0	Fa
	7856.4	3.?	Fc	7864.8	3.2	Va		7871.6	3.3	Ah	7876.8	3.9	Hv
	7856.5	3.3	Ap	7864.8	4.2	Hu		7871.7	3.7	SI	7876.8	3.8	Si
	7856.6	2.8	Ks	7864.8	3.2	Ma		7871.7	3.9	Hf	7876.8	4.1	Ie
	7856.7	3.1	Ar	7864.8	3.8	Pb		7871.7	3.7	Rd	7876.8	4.0	Sf
	7856.8	2.7	Ar	7864.8	3.7	Hk		7871.7	3.5	Kp	7876.9	3.9	Pb
	7857.0	2.9	Ar	7864.8	4.0	Ar		7871.8	3.8	Wq	7876.9	3.8	Si
	7857.5	3.0	Ap	7864.9	3.8	Hk		7871.9	3.8	SA	7876.9	3.9	Ar
	7857.6	3.2	Ks	7864.9	3.9	Pb		7872.1	3.3	Kd	7877.0	3.9	Ar
	7857.4	3.5	Ch	7865.0	3.7	Hk		7872.5	3.6	Ah	7877.1	3.8	Ra
	7857.9	3.2	Ha	7865.0	3.7	Ar		7872.6	3.6	Ks	7877.5	3.6	Rc
	7858.4	2.6	Ch	7865.5	3.7	Ap		7872.7	4.2	Lf	7877.5	4.2	Ah
	7858.5	3.0	Ap	7865.6	3.7	Ks		7872.7	4.2	Pb	7877.7	4.0	Hv
	7858.7	2.6	Ks	7865.7	3.8	Pq		7872.7	3.7	Hv	7877.7	4.0	Hk
	7858.8	3.0	Rd	7865.7	3.7	SA		7872.8	4.4	Hk	7877.7	4.3	Pb
	7858.8	3.1	Wq	7865.7	3.8	Lz		7872.8	3.2	Fr	7877.7	4.1	Dh
	7858.8	2.8	Wn	7865.7	3.2	Va		7872.8	4.0	Hi	7877.8	3.9	Gn
	7859.4	3.2	Fc	7865.7	3.8	Wq		7873.1	3.7	Kd	7877.8	4.0	Ar
	7859.4	2.5	Ch	7865.7	3.8	Kp		7873.4	3.9	Ah	7877.8	4.0	Hk
	7859.5	3.0	Ap	7865.7	3.4	L		7873.5	3.7	Ah	7877.8	4.1	Dh
	7859.6	3.0	Ks	7865.8	3.6	Wk		7873.6	3.6	Ks	7877.8	4.1	Ha
	7859.9	2.9	Ar	7866.1	3.8	Kd		7873.7	3.9	Hk	7878.5	4.1	Ah
	7860.0	2.9	Ar	7866.5	3.7	Ah		7873.8	3.8	Hk	7878.8	3.8	Va
	7860.4	3.4	Ks	7866.5	3.8	Ap		7873.9	3.9	Ar	7878.8	3.9	Rd
	7860.6	3.2	Ks	7866.7	3.7	Ks		7873.9	3.9	Pb	7878.9	3.7	Ra
	7861.0	3.0	Ar	7866.7	3.2	Fr		7874.0	3.7	Sx	7879.6	4.2	Dl
	7861.5	3.3	Ap	7866.7	3.8	Hk		7874.0	3.9	Ar	7879.6	4.3	SI
	7861.6	3.3	Ks	7866.8	4.2	Hu		7874.5	3.9	Ah	7879.7	4.0	SA
	7861.6	3.6	SI	7866.8	3.9	Pb		7874.6	3.8	Ah	7879.7	4.0	Lz
	7861.7	3.0	Wq	7866.8	3.8	Fn		7874.6	4.0	Ah	7879.7	4.0	Va
	7861.7	3.4	SA	7866.8	3.8	Hk		7874.6	3.7	Ks	7879.7	3.9	Hx
	7861.7	3.7	Pq	7867.0	3.7	Hi		7874.7	3.7	Hx	7879.7	4.0	Wq
	7861.7	3.1	Rd	7867.1	3.4	Kd		7874.8	3.7	Lf	7879.8	4.0	Ms
	7861.8	3.4	Wk	7867.5	3.5	Ah		7874.8	3.8	Hk	7879.8	4.1	Pb
	7861.8	3.1	Ms	7867.6	3.7	Ap		7874.8	4.0	Hi	7879.8	4.1	Hv
	7861.8	3.1	Gn	7867.6	3.3	Ah		7874.8	3.7	Pb	7879.9	4.1	Dl
	7861.8	3.7	Hx	7867.6	3.5	Ks		7874.9	3.6	Si	7880.7	4.5	Wa
	7861.8	3.8	Wn	7867.7	3.5	Ks		7875.0	3.6	Si	7880.9	4.5	Pm
	7862.4	3.8	Fc	7868.1	3.1	Kd		7875.7	3.7	Lz	7881.8	4.7	Hi

VARIABLE STAR OBSERVATIONS RECEIVED DURING APRIL, 1935.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
180445 NOVA HERCULIS—							180445 NOVA HERCULIS—						
	7882.4	4.8	Ah	7888.5	4.2	Rc		7890.6	4.5	Rb	7896.7	7.8	SG
	7882.6	4.4	Rb	7888.6	4.7	Cm		7890.7	4.4	Wa	7896.7	8.2	Jo
	7882.7	4.0	Pq	7888.6	4.5	Hm		7890.7	4.9	Cm	7896.8	8.3	Wk
	7882.8	4.8	Hi	7888.7	4.9	C		7890.7	4.4	Dl	7896.8	8.6	Ol
	7883.5	4.8	Ah	7888.7	4.6	SG		7890.8	5.0	Pg	7897.6	8.4	C
	7883.6	4.8	Ah	7888.7	4.6	SA		7890.9	4.4	Bk	7897.7	8.2	Sf
	7883.7	4.3	Ba	7888.7	4.3	Sf		7890.9	4.4	Si	7897.7	8.0	SG
	7883.7	4.1	Pq	7888.7	4.9	Hw		7891.0	4.5	Si	7897.8	8.2	Jo
	7883.8	4.2	Fr	7888.7	4.7	Rb		7891.5	4.0	Hm	7897.9	8.3	Wk
	7883.8	4.1	Ar	7888.7	5.0	Gy		7891.6	4.4	Rb	7898.1	8.4	Kd
	7883.9	5.1	Hk	7888.7	4.6	Wd		7891.7	4.3	Wa	7898.2	8.7	Kd
	7883.9	4.4	Ha	7888.7	4.3	Wa		7891.7	4.0	Ba	7899.6	8.2	C
	7883.9	3.8	Wk	7888.7	4.3	Rd		7891.7	4.8	Rd	7899.6	8.2	Fa
	7883.9	4.4	Dl	7888.7	4.3	L		7891.7	4.6	SG	7899.7	8.4	Jo
	7883.9	4.9	Ra	7888.7	4.2	Ar		7891.8	4.3	Hf	7899.7	8.4	SG
	7884.1	4.8	Kd	7888.7	4.5	Dl		7891.9	4.9	Pm	7899.9	8.6	Wk
	7884.7	3.7	Jo	7888.7	4.2	Hk		7892.7	4.3	Wq	7900.1	8.8	Kd
	7884.7	4.3	Wa	7888.7	4.5	Ha		7892.7	4.4	Jo	7900.6	8.1	Fa
	7884.8	4.2	Ar	7888.8	4.4	Ra		7892.7	5.0	SG	7900.7	8.3	St
	7884.8	4.2	Hi	7888.8	4.0	Ba		7892.8	4.5	Es	7900.7	8.4	Jo
	7884.9	4.5	Ha	7888.8	4.2	Pb		7892.8	4.4	Ra	7900.7	8.5	SG
	7885.4	4.7	Ah	7888.8	4.1	Hf		7892.8	4.6	Va	7902.8	8.4	Pg
	7885.5	4.0	Rc	7888.8	4.2	Wk		7892.8	4.4	Hu	7903.6	9.5	St
	7885.7	4.5	Hk	7888.8	4.4	Fn		7892.8	4.5	Md	7903.7	9.8	Fa
	7885.7	4.6	Hu	7888.8	4.6	Ha		7892.8	4.5	Hv	7903.7	9.4	C
	7885.7	4.6	Dh	7888.8	4.8	Bs		7892.9	5.0	Pm	7903.7	9.7	SG
	7885.8	4.2	Va	7888.8	4.3	Hk		7892.9	4.9	Dh	7904.6	9.4	C
	7885.8	4.6	Rd	7889.4	4.6	Mh		7893.7	4.7	Fa	7904.6	9.5	SG
	7885.8	4.6	Ar	7889.6	4.5	Hm		7893.7	4.3	Jo	7906.7	9.9	Cm
	7885.8	4.6	Ra	7889.6	4.3	Wa		7894.8	5.3	Md	7910.6	10.1	C
	7885.9	4.7	Dh	7889.6	4.8	Kp		7895.1	5.6	Kd	7910.6	10.5	SG
	7886.5	4.1	Rc	7889.6	4.4	Wp		7895.7	7.0	Fa	7910.7	10.3	Ol
	7886.6	3.7	Hm	7889.7	4.6	C		7895.7	7.0	Wk	7910.8	10.2	Ol
	7886.7	4.1	Wa	7889.7	4.3	Hk		7895.7	6.8	SG	7911.6	10.6	Rb
	7886.8	4.5	Ms	7889.7	4.5	Rd		7895.8	6.7	Md	7912.6	11.0	C
	7886.8	4.5	Ma	7889.7	4.8	Dh		7896.6	7.9	Wd	7916.7	12.0	C
	7887.1	4.0	Kd	7889.7	4.4	Fn		7896.6	8.0	Rb	7916.7	12.0	Hj
	7887.4	3.7	L	7889.7	4.2	Gy		7896.6	8.4	C	7917.6	12.2	SG
	7887.5	3.9	Bs	7889.7	4.4	Si		7896.7	8.5	Ol	7918.7	12.5	C
	7887.6	4.1	Sl	7889.7	4.4	Fa		7896.7	8.1	Fa	7923.6	13.0	C
	7887.6	3.9	Gy	7889.7	4.0	Jo	202946 SZ CYGNI—						
	7887.7	4.3	Ar	7889.7	4.9	Bs		7906.9	9.0	Pt			
	7887.7	4.0	Rd	7889.7	4.2	St	213843 SS CYGNI—						
	7887.7	4.0	Dl	7889.7	4.8	SG		7804.0	11.9	Ch	7876.9	12.2	Ar
	7887.7	3.8	Pb	7889.8	4.5	Gn		7810.0	12.1	Ch	7876.9	12.3	Pb
	7887.7	4.2	Wk	7889.8	4.3	Ar		7830.0	11.8	Ch	7879.9	12.1	Pb
	7887.7	4.1	Fa	7889.8	4.2	Hk		7842.0	8.3	Ch	7887.8	11.9	Jo
	7887.7	3.9	Wq	7889.8	4.5	Hu		7863.8	11.5	Pb	7888.8	11.9	Gy
	7887.7	4.3	C	7889.8	4.5	Si		7864.9	11.9	Pb	7889.8	12.0	Jo
	7887.7	4.0	SG	7889.8	4.0	Ba		7864.9	11.9	Ar	7890.9	11.9	Ma
	7887.8	4.2	Jo	7889.8	4.3	Hi		7872.6	11.8	Ah	7892.8	11.8	Hv
	7887.8	4.1	Gn	7889.8	4.3	Hw		7873.9	12.2	Pb	7896.7	11.9	Jo
	7887.8	4.1	Ok	7889.9	4.7	Ol		7873.9	12.2	Ar	7899.8	11.9	Jo
	7887.8	4.2	Hi	7889.9	4.0	Dl		7874.6	11.8	Ah	7906.8	12.2	Cm
	7887.9	4.4	Hk	7889.9	4.8	Pm		7874.9	12.1	Pb	7906.9	11.7	Pt
	7887.9	4.4	Ha	7889.9	4.2	Cl		7875.6	12.0	Ah			
	7888.1	4.6	Kd	7890.6	4.7	Kp							

SUMMARY FOR APRIL, 1935.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Adamopoulos	Ap	1	14	Kirkpatrick	Kp	12	33
Ahnert	Ah	27	130	Knott	Kt	1	8
Armfield, D	Af	5	5	de Kock	dK	14	55
Armfield, L.	Ar	52	185	Koons	Kn	13	14
Ballhaussen	Ba	11	26	Kotsakis	Ks	1	17
Bappu	Bm	32	141	Lachini	L	14	19
Belsham	Bj	84	117	Lazarus	Lz	1	6
Benini	Be	41	48	Loepfe	Lf	6	10
Blunck	Bu	3	5	Loreta	Lt	35	110
Bouton	B	60	103	Marchesini	Mh	3	31
Brady	By	10	13	Marsh	Ma	57	75
Brocchi	Br	17	22	Means	Ms	1	6
Brockmeyer	Bk	5	6	Millard	Md	23	56
Brown, S. C.	Bs	38	84	Miller	Mi	10	11
Callum	Cl	19	34	McLeod	Mc	5	5
Campbell	C	1	13	O'Keefe	Ok	1	2
Chandra	Ch	172	365	Oliver	Ol	1	5
Christman	Cm	56	86	Peck	Pb	56	115
Dafter	Df	6	21	Peltier	Pt	85	86
Dalton	Dt	3	3	Perkinson	Pk	5	5
Diedrich	Dh	17	49	Preucil	Pf	14	19
Doolittle	Dl	29	178	Previll	Pm	2	7
Ellis	Es	19	22	Proctor, R.	Pq	1	6
Ensor	En	45	79	Purdy	Pg	14	16
Farnsworth	Fa	2	13	Raphael	Ra	36	42
Fish	Fs	6	6	Recinsky	Rc	13	44
Focas	Fc	37	89	Reed, D. S.	Rd	1	13
Frister	Fr	9	12	Rosebrugh	Rb	28	60
Friton	Fn	16	33	de Roy	Ry	10	71
Gaposchkin,S.	SG	1	14	Salanave	Sx	19	20
Grant	Gn	1	5	Seely	Sa	2	4
Gregory	Gy	67	85	Shinkfield	Sl	16	35
Haas, W.	Ha	4	19	Shultz	Sz	9	11
Halbach	Hk	73	145	Simpson, J. W.	Si	32	53
Hamilton, R.	Hm	26	148	Smiley	St	1	3
Hamilton, W.	Hx	1	5	Smith, F. P.	Sq	14	23
Hartmann	Hf	116	351	Smith, F. W.	Sf	13	24
Harwood	Hw	1	2	Smith, L.	Sh	13	13
Heines	Hh	3	6	Smith, T.	SI	1	5
Hildom, A.	Hi	8	33	Swann	SA	1	7
Holt	Hb	12	14	Vaughan	Va	1	6
Houghton	Ht	66	250	Wade	Wh	5	5
Houston	Hu	23	38	Walton	Wu	2	6
Howells	Hj	1	1	Watson, P.	Wa	24	84
Howes	Hv	5	27	Webb	Wd	41	49
Huruhata	Hw	1	2	Wesolowski	Wq	1	8
Iedema	Ie	7	8	Weston	Wk	1	11
Jansen	Je	9	17	Wilson, H. Z.	Wn	1	22
Jones	Jo	123	414	Woods	Wp	20	75
Kanda	Kd	19	134	Young	Y	1	16
King	Kg	10	10				
				Totals	101	395	5057

Only persistent observation of this star for several months to come will answer this question. A "c" type chart, showing the faint comparison stars is available for distribution to those who may be able to follow the Nova while faint. This chart may be obtained by writing directly to the Recorder. Users of this chart will estimate the star in terms of the nomenclature cited on the chart, reporting

the actual estimates made, using in preference the proportional method of estimation; as, so many tenths of the way from a slightly brighter comparison star to a slightly fainter one. For example, w4 N 6x would indicate that the Nova was 0.4 of the way in brightness from "w" to "x".

A splendid example of class work in an elementary course in astronomy is shown by the work of eleven Harvard students who were expected to observe the Nova on each available occasion. The accordance of their results justifies the attempt and offers a suggestion along similar lines for other important variables and bright novae.

R Coronae Borealis is trying hard to regain its normal maximum brightness, but evidently with many unsuccessful attempts, as evidenced by the observations of the past few months.

LEON CAMPBELL, Recorder.

May 10, 1935.

Meteor Notes from the American Meteor Society

By CHARLES P. OLIVIER, President

One of the most interesting of all the annual showers is that of the Eta Aquarids, which occurs during the early part of May. This year the moon was fortunately absent on the nights near maximum. While it is too early to expect any reports from a distance, we have received records from F. W. Smith, of Glenolden, Pennsylvania, who observed on 1935 May 7-8 in a clear sky from 13:45 to 15:45 and saw 22 meteors of which 13 were Eta Aquarids. All of these were plotted and an excellent radiant was derived at $\alpha = 336°.0$, $\delta = -2°.5$ (AMS Radiant No. 2818). He observed also on May 11-12 from 11:20 to 15:20, with conditions again good. This time only two Aquarids were seen; their paths, nearly at right angles, gave an intersection at $\alpha = 335°.0$, $\delta = 0°.0$. Four sporadic meteors gave a good radiant at $\alpha = 281°$, $\delta = -1°$ (AMS No. 2819). These observations prove that, as in 1910, Aquarids may be seen as late as May 11. Also we see that although Halley's Comet has now passed perihelion by twenty-five years, these meteors are still coming in moderate numbers, better in fact than the Leonids do when far from their maximum. We hope that our members all over the country made a real effort to observe these important meteors.

Our last membership list was issued in August, 1934, as AMS Bulletin No. 15. The following list includes new members since that date and a few names which were omitted from Bulletin 15:

Mrs. J. D. Williams, 4181 University Station, Tucson, Arizona.
Mrs. Helen Lewis Thomas, Harvard College Observatory, Cambridge, Massachusetts.
John Forbes, 746 Fulford Street, Montreal, Canada.
C. M. Schell, 1023 Y.M.C.A., Dayton, Ohio.
Walter Armstrong, 3251 Tulamare Roard, Cleveland Heights, Ohio.
David Dickinson, 2300 S. Clayton Street, Denver, Colorado.
*Lewis L. Doolittle, P. O. Box 341, So. Norwalk, Connecticut.
Walter C. Wegner, 1020 South East Avenue, Oak Park, Illinois.
*Vernon Cook, Pierceville, Kansas.
*R. Gardner Reed, 309 Stafford Road, Fall River, Massachusetts.
John Kiernan, CCC Co. 1279, S. P. 15, Bassett, Virginia.
James S. Andrews, 3 Addison Avenue, Rutherford, New Jersey.
*Allan Fairchild Cook II, 259 Tuttle Parkway, Westfield, New Jersey.

*Probational.

Wm. B. Albrecht, 6645 W. Burleigh Street, Milwaukee, Wisconsin.
*George Diedrich, 3331 W. National Avenue, Milwaukee, Wisconsin.
John Buddhue, 99 S. Raymond Avenue, Pasadena, California.

It will be of general interest to the American Meteor Society that in April the American Philosophical Society made a most generous grant to me, the money to be used in securing an assistant for 1935-36, all of whose time shall be spent in carrying forward a study of meteor trains and accompanying phenomena. As we have the notes and papers (at least all that could be found) of the late Professor C. C. Trowbridge, who did so much for this subject, as well as all the data that have come to the A.M.S. since its founding, we hope that a real contribution can be made along these lines. We earnestly request anyone who has unreported data on meteor trains of long duration please to send in these data or copies of them.

A paper dealing with long enduring trains was given by me at the Washington meeting of the Geophysical Union in April. One of its purposes was to call attention to the desirability of coöperation on the part of scientists interested in the earth's atmosphere in the gathering of meteor train data. There is no doubt that many long-enduring trains appear over the United States each year, but only for very few are we able to obtain enough information to make calculations of drifts possible. This is a condition that can be changed only by a most persistent policy of urging upon everyone the importance of observing such phenomena on the rare occasions which present themselves to any individual.

We continue to receive dozens of would-be "meteorites." Most people have no slightest reason for suspecting such an origin for the rocks submitted. Everything from sandstone to furnace clinkers has come, but to date nothing meteoric. Just because a stone is not exactly like its nearest neighbors is no reason for thinking it fell from the skies!

Attention should be called to a most important paper, "The Ionizing Effects of Meteors," by A. M. Skellett. It is the Bell Telephone Technical Publication, Monograph B-853. All persons seriously interested in meteoric astronomy should obtain copies.

Meteor Heights, 1934 Leonid Epoch

PART II. STATE GROUPS

By Doris M. Wills

On November 14-15 and 15-16 last year our Wisconsin observers manned four stations to plot meteors for heights. The organization was under the general guidance of L. E. Armfield, Milwaukee Astronomical Society. The stations and their personnel were as follows:

1—Milwaukee. Milwaukee Astronomical Society: *Group A*—L. E. Armfield (Nov. 15-16), E. A. Halbach (Nov. 14-15), Wm. Liebscher, and C. P. Frister. *Group B*—L. E. Armfield (Nov. 14-15), J. V. Gabris, C. C. Steven, and E. A. Halbach (Nov. 15-16). *Recorder for both groups*—A. F. Boyd.

2—Reedsburg. Reedsburg Astronomical Society: Jack B. Vinson, Miss Vida J. Niebuhr, Paul M. Loofboro, Miss Lydia Luebke, and Fred Niebuhr.

3—Madison. Madison Astronomical Society under the leadership of J. M. English: Tom Binney, Clarence Draeger, John McClain, Walter Foster, Leslie Ketchum, Adolph Frick, James Bennet, Albert Levy, Walter Houston, Harold Jacobs, Mrs. Tom Binney, Mrs. Leslie Ketchum, Henry Wright, J. C. Gamroth, Dr. Supernaugh, and Rev. Lookabill.

4—Beloit. Beloit College Astronomy students under the leadership of Professor R. C. Huffer.

Station 4 had cloudy skies on the second night. Otherwise observing conditions were fairly good.

From the paths recorded, we have computed heights for the 20 meteors given in Table I. The method of computation was the usual graphical construction with altitudes and azimuths. The columns in order give the serial number of the meteor, date, C.S.T., average estimated magnitude, beginning height and the average deviation from the mean, end height and average deviation, the class of the meteor (Leonid or Sporadic), and numbers of stations contributing observations. For the observing time and effort spent, the results are fewer than might be expected; but it must be remembered that the shower was not good and that bright meteors were extremely scarce.

TABLE I

WISCONSIN NETWORK

No.	1934 Nov.	C.S.T. h m s	Mag.	Beginning Height km	End Height km	Class	Stations
1	14-15	12:21:20	4.5	97±10	71±10	S	1B, 2
2		12:35:25	3	79 5	75 8	S	3, 4
3		12:55:20	1.5	133 20	87 9	S	2, 3
4		13:07:48	2.5	..	83 4	S	1A, 4
5		13:35:26	4	99 12	72 6	L	1A, 2
6		13:54:50	2	169 17	73 14	S	1B, 4
7		15:33:26	2.5	110 8	108 11	L	1A, 4
8	15-16	11:40:05	2	..	127 3	S	2, 3
9		12:01:30	3	152 16	..	L	2, 3
10		12:06:33	3	125 18	107 2	S	1B, 3
11		12:46:38	1.5	117 17	82 15	S	1B, 2
12		12:49:46	2	79 10	..	L	2, 3
13		13:20:45	2	142 1	47 5	L	2, 3
14		13:35:08	2	137 15	112 21	L	1A, 2
15		14:06:24	2	164 7	108 6	S	1B, 3
16		14:20:03	0.5	131 4	113 11	L	1B, 2
17		14:36:09	2.2	116 *	97 *	L	1A, 2
18		15:00:00	1	60 3	60 1	S	1A, 3
19		15:28:46	0.5	..	164 1	L?	1A, 2
20		16:31:53	2	126 18	..	L	1B, 2

*Graphical solution; no mean deviation found.

TABLE II

CORRECTIONS TO HEIGHTS FOR 1933 LEONID EPOCH

Old No.	1933 Nov.	C.S.T. h m s	Mag.	Beginning Height km	End Height km	Class
3	15-16	12:12:21	0.5	84±17	85± 2	L
11		15:38:51	0.5	105 18	20 15	L
13		16:07:25	2	75 8	72 6	S
14	16-17	12:44:40	2	114 0	98 13	S?
15		12:49:27	3	99 12	..	S
16		12:53:45	1	109 20	99 14	L
17		13:47:42	3	118 12	112 10	L
Additional heights computed:						
19	15-16	13:16:21	2	97 14	64 10	S (A)
20		15:16:39	2.5	69 3	56 2	L (B)

(A) Stations 1, 3 (2); (B) Stations 1, 2 (2).

In working up these observations, it was found that in computing the 1933 Wisconsin Leonid heights, the positions of two stations had been used incorrectly, although the observers had reported them properly. These positions affected eight of the heights given in Meteor Notes for May, 1934. One of the heights, No. 12, proves not to be from duplicate observations, and should be omitted from the list. The heights of two additional meteors could be found. Values for these two and revised values for the other seven are given in Table II. Means for the revised seven differ by about 2 km from those for the seven heights as originally published.

Heights from observations by groups in Colorado, Kentucky-Tennessee, Michigan, and Ohio will be published in later Meteor Notes.

Flower Observatory of the University of Pennsylvania,
Upper Darby, Pennsylvania, 1935 May 14.

The Detonating Meteor of January 24, 1934

By C. C. WYLIE

This spectacular meteor fell at about 11:00 P.M., 90th meridian time. Nine observers were interviewed in and near Iowa City, Iowa, by Bemrose Boyd, Ethel Roorda, and myself. Five observers were interviewed in Cedar Rapids, Iowa, by the same persons. Two observers were interviewed in Marengo, Iowa, by Bemrose Boyd and myself. One observer was interviewed on the Pitlick farm near Tiffin, Iowa, by Bemrose Boyd and myself. Two observers were interviewed in Oskaloosa, Iowa, by C. C. Sherman. One observer was interviewed in Dubuque, Iowa, by Father J. A. Theobald. One observer was interviewed in Dyersville, Iowa, by a student taking general astronomy. One observer was interviewed in Beloit, Wisconsin, by R. C. Huffer. In addition, observers who had seen the meteor from Wellman, from Marengo, and from near Amana, reported in person to me at Iowa City. The Wellman observer had plotted the path, as seen from his window, with respect to the Big Dipper. Letters reporting observations of the meteor were also received from many other points in Iowa.

Light

The brightness of this meteor is illustrated by the fact that our local newspapers confused the names Wylie and Reilly in printing the account of this meteor, probably because of the similarity in sound of the names. Yet the account as printed was essentially true. Mrs. C. C. Wylie, in an upstairs bedroom, saw a brilliant greenish light around the frame of a west window for which the shade was drawn. The newspapers, learning of this, printed that Mrs. John F. Reilly had seen the illumination at a west window of her bedroom. Although the account was printed by error, it was found to be true. Mrs. Reilly had seen the illumination at a bedroom window. The brightness is also illustrated by the account of an Iowa City man who was driving near Amana, Iowa, when the meteor fell. He was going around a curve when the surroundings lighted up brilliantly, and as he looked about to see what was the matter, he let his car go almost into a ditch. One Iowa City lady admitted frankly that she thought the Day of Judgment had arrived. Other persons who did not tell us so frankly were, according to friends present, badly frightened.

We received seventeen estimates of the light from observers. One, a man in a well-lighted part of Cedar Rapids, estimated that it was not quite as bright as

the moon. Another, at Beloit, Wisconsin, estimated that it was equal to the moon. Six estimated brighter than the moon. Three estimated much brighter than the moon. Two estimated brighter than the moon but not so bright as day. One estimated the light as about that of a cloudy day. One estimated almost as bright as sunlight. This last estimate was by a lady standing in her garage door in such a position that the meteor lighted up the interior of the garage. Four gave estimates of the brightness using ten steps between moonlight and sunlight. We have adopted —17 as the probable magnitude.

The Bursting Point

For determining the bursting point, an azimuth was adopted for Cedar Rapids, Iowa City, Marengo, and the Pitlick farm near Tiffin. The measured angles for Oskaloosa, Beloit, and Dyersville were not used, since we had a considerable number of measures within less than 25 miles of the bursting point. The projection of the adopted bursting point is longitude 91° 49′.2, latitude 41° 48′.3, and the probable error is ±0.3 miles. This is a point about two and one-half miles east, and slightly north of Amana, Iowa. The height of bursting was found to be 6.4 miles. The point of bursting was very nearly over the Iowa river, a poor place to search for the possible meteorites.

The Radiant

The radiant was determined by using apparent slopes reported from Iowa City, Cedar Rapids, Marengo, Wellman, and the Pitlick farm. It was found to be azimuth 334° 51′ from the south point, and altitude 55° 38′. The probable error was found to be ±0°.3. This is the radiant as seen from the bursting point. The ground point was found to be longitude 91° 51′.3, and latitude 41° 51′.6. The radiant as seen from the ground point was azimuth 334° 49′.6, and altitude 55° 34′.7. Correcting for zenith attraction and diurnal aberration, and reducing to right ascension and declination, the result is: right ascension 120° 56′.5, and declination +6° 37′.7.

Noticeable Illumination

The point of noticeable illumination was determined from the angular length of path as reported from Beloit, Wisconsin, and Iowa City, Oskaloosa, Dubuque, Wellman, and Marengo in Iowa. This was found to be longitude 91° 37′.1, and latitude 41° 29′.1. This is a point about 13½ miles south, and a little west, of Iowa City. The height of the path at this point was determined as 42.1 miles. The length of the path from illumination to bursting was 43.2 miles, and the projected length was 28.4 miles.

Velocity

Estimates and reproductions of duration on this meteor were obtained from Cedar Rapids, Beloit, Dubuque, and Attica. Of these the Cedar Rapids and the Beloit durations were considered to be the best. The weighted mean for the duration from illumination to bursting was determined as 3.4 seconds. This gives for the apparent velocity 12.4 miles per second, for the geocentric velocity 10.2 miles per second, and for the heliocentric velocity, 21.6 miles per second. This meteor, like the two other well-observed meteors for which we have recently published results, appears to have been a member of the solar system.

Detonations

Detonations were heard in Iowa City, Wellman, Tiffin, Amana, and by farmers within this area. They were not, in general, loud enough to attract the attention of people indoors who had not seen the meteor. At Iowa City the sound

was like distant thunder, loud enough that anyone who had seen the meteor would notice the thunder and associate it with the meteor. I heard the detonations myself, as when they arrived I was outdoors looking at the western sky. As stated previously, my wife saw the illumination at a west window of a bedroom. She told me about it perhaps a minute later when I stepped into the room. This enabled me to get outdoors in time to hear the detonations. At some of the farms within the area, the detonations were much louder, loud enough to frighten persons.

We obtained two re-enactions, involving walking, of the interval from the light of the meteor to the hearing of the detonations. The best was obtained from two Iowa City young ladies who were walking home at the time of the fall of the meteor. When the meteor appeared they were underneath a rather large tree, so that the place was well marked. When the detonations arrived, they were by the door of an apartment house, and again the place was quite well marked. We had these young ladies walk together just as they did on the night the meteor fell and obtained almost exactly 100 seconds as the interval from the fall of the meteor to the hearing of the detonations. As it appeared we had a very complete re-enaction of the incidents, considerable weight was attached to this figure at the time it was obtained. Assuming that the sound traveled 1050 feet per second, which is probably near the truth, the computed interval for these young ladies is 97 seconds.

Another value for the interval was obtained from a man who was walking with his wife when the meteor fell. He thought he could recall quite well where he was when the meteor fell and where he was when the detonations were heard. We timed him, walking that interval, but his wife was not present, so we did not have a complete re-enaction. A note was made at the time that he probably walked faster than he would have if his wife had been with him. This man saw the meteor from a place not very distant from the place previously mentioned where it was seen by the two young ladies, so that the correct time interval was probably not very different from the 97 seconds computed for them. The figure 70 seconds was obtained for this observer indicating that he did walk too fast. No attempt was made to have persons seeing the light from bedroom windows or parked cars reproduce the interval, as for these there was no definite action to reproduce.

The uncertainty of the mere estimates from average persons is illustrated by the following. One observer, for whom the interval was computed as 52 seconds, guessed three to four seconds. Another, for whom the interval was computed as 114 seconds, guessed 15 seconds.

The Observational Data

As the meteor fell in the winter, no one was sitting out doors in his yard. Hence the type of observation which was used almost exclusively for the meteor of July 25, 1929, (see these Notes for April, 1935) was not available. However, we had one observation from a bedroom window in Iowa City, and one from a window in Wellman. The remaining persons whose observations were measured in Iowa City, Cedar Rapids, and Marengo all saw the meteor from familiar surroundings in their own yards or on the street. Two were in their yards, walking from the garage or car to the house, when the meteor fell; two were sitting in parked cars; and the remainder were walking on familiar streets when the meteor fell. An interesting observation was obtained from Mr. Charles L. Berry, a farmer living a few miles south of Iowa City. He was in his bedroom near a north

window when the meteor fell. He noticed the yard light up brilliantly and saw the shadow of his windmill tower sweep rapidly across the yard toward his window. The light went out when the shadow was perhaps fifteen feet from the window. By measuring the direction of the windmill tower from that point, the direction of the meteor at the time of bursting was obtained, although Mr. Berry had not seen the meteor at all. His direction agreed well with those obtained in the more conventional way.

Two mirror vision reports were obtained on this meteor, one from Iowa City and one from Cedar Rapids. These observers pointed out an end point agreeing fairly well with others, but reported that the meteor had fallen from right to left, although, according to all other reports in those communities, the meteor had fallen from left to right. One of the first letters received on this meteor contained the statement that the meteor had fallen nearly vertically downwards. When we began our interviews it became evident that this slope was discordant. It afterwards developed that the slope of the meteor at that point appeared about as far from vertical as possible.

ACKNOWLEDGMENT

The computations on this meteor have been made in duplicate by Ethel Roorda and L. R. Wylie. The work has been supported in part by grants from the Graduate College of the University of Iowa and in part by a grant from the J. Lawrence Smith Fund of the National Academy of Sciences.

SUMMARY

The accompanying map shows the projected path of the meteor. The height

of the path in miles is indicated, and the places from which detonations were reported are also indicated. The following presents the principal results in tabular form.

Longitude end point	91° 49′.2
Latitude end point	41° 48′.3 ± 0′.3
Height end point	6.4 miles
Longitude appearance	91° 37′.1
Latitude appearance	41° 29′.1
Height appearance	42.1 miles
Length path	43.2 miles
Projected length	28.4 miles
Apparent velocity	12.4 miles
Heliocentric velocity	21.6 miles
Azimuth radiant	334° 51′
Altitude radiant	55° 38′ ± 0°.3
R.A. corrected radiant	120° 56′
Decl. corrected radiant	+6° 38′
Estimated magnitude	—17

University of Iowa, May 18, 1935.

Contributions from the Society for Research on Meteorites

Edited by FREDERICK C. LEONARD, President, *and* H. H. NININGER, Secretary

The S. R. M. made an "Associated Society" of the A. A. A. S.

The President is pleased to announce that he has received a letter, dated April 24, 1935, from Dr. Henry B. Ward, Permanent Secretary of the American Association for the Advancement of Science, in Washington, D. C., which advises that:

"At its recent meeting in New York City, the executive committee [of the Association], in response to the request in your letter, voted to accept the Society for Research on Meteorites as an associated society."

Appointment of Committees on Incorporation and Membership

At the Organization Meeting of the Society in August, 1933, the President and the Secretary were charged by the Charter Members present with the duty of caring for the matter of the incorporation of the Society. Just as soon as certain proposed amendments to the Constitution and the By-Laws, which are now before the members for consideration, have been acted upon at the Third Annual Meeting, the Executive Committee of the Council (the President and the Secretary) will proceed with the legal business incident to having the Society incorporated. With this end in view, the President has named a *Committee on Incorporation*, consisting of himself and the Secretary, *ex officiis*, and Mr. Nathan Schwartz, A.B., C.P.A., 1523 N. Alexandria Avenue, Los Angeles, California, as the specially appointed member.

A *Committee on Membership*, composed of Mr. Robert W. Webb, Department of Geology, University of California at Los Angeles, *Chairman*, Mr. Oscar E. Monnig, 312 W. Leuda Street, Fort Worth, Texas, and the Secretary, *ex officio*, likewise has been established by the President. This Committee will concern itself with all matters pertaining to membership except such as are provided for in the Constitution and the By-Laws.

The Third Annual Meeting of the Society

The attention of members, and of others interested, is called to the notice in

the May issue, pp. 318-19, of the Third Annual Meeting of the Society, to be held at the University of Minnesota, Minneapolis, on June 26 and 27, 1935, in connection with the summer meeting of the A.A.A.S. All the scientific sessions of this meeting will be open to the public, and visitors will be welcome.

Secretary's Office: The Nininger Laboratory, 1955 Fairfax Street, Denver, Colorado.

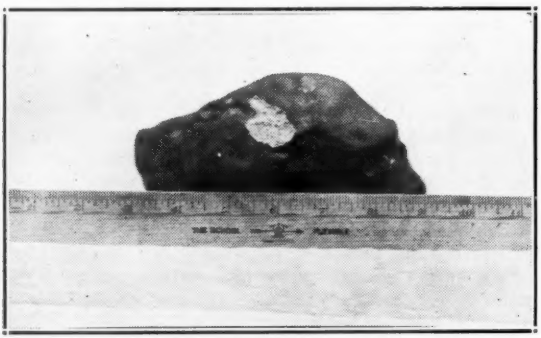
Editorial Office: The Department of Astronomy of the University of California at Los Angeles.

The Fayetteville, Arkansas, Meteorite

A five pound meteorite was recovered shortly after its fall just before noon on December 26, 1934, near Fayetteville, Arkansas. The time was about 11:58 A.M. All reports agreed pretty well as to the time, because of the noon whistles of lumber mills near.

About 3½ miles due west of the University of Arkansas two men, Pearl Conley and Ray Brisco, were cutting wood when they heard the "explosions" and the rumbling of the meteor. They heard a dull thud near them and felt a change in the air currents. "It seemed as if the breeze just died," was their description. They could not tell just where the stone had fallen, but noticed the actions of a herd of cattle in a field near, which led them to look there. They found the hole, which was about twelve or fifteen inches in diameter and three or four inches deep, in a few minutes—so soon, in fact, after the fall that the earth was still warm and slight traces of smoke were still around the hole.

They began digging with their hands but it seemed it would be some distance to the stone so a shovel was brought from a neighboring house and the stone



PHOTOGRAPH OF FAYETTEVILLE METEORITE.

soon reached, about 20 inches down in a cultivated field. The stone was luke warm when they first touched it. A small piece, about the size of a half dollar, was cracked in the fall. This was immediately broken off, revealing the grayish stone interior.

The meteor was going in a southwesterly direction at an angle of about 70 degrees with the horizontal, though Bristo and Conley gave this angle as about 45 degrees. The smoke trail was estimated by various observers in Fayetteville to be fifteen or twenty degrees and to lie mainly east of the meridian, though some said the middle of the trail was on the meridian.

From the place of fall the smoke showed as a ball, not a trail, which appeared to expand as the observers watched it. One observer from Lincoln, Arkansas, about fifteen miles west southwest, reported the smoke as a large cloud which looked like a "fifty gallon barrel."

The wind was still on the day of the fall so the smoke persisted for some time, gradually dissipating.

The noise attracted the attention of many observers and seems to have been several sharp explosions followed by lesser explosions which faded into a rumbling. One observer reported that his first thought was that Gabriel was blowing his trumpet. The meteor caused windows to rattle in Fayetteville and nearby towns, even as far away as Eureka Springs, Arkansas, about fifty miles northeast.

Observations of the meteor were reported from all towns near and from others such as Perry, Oklahoma, 225 miles west, Okmulgee, Oklahoma, 150 miles west, Talahina, Oklahoma, 125 miles northeast, and Harrison, Arkansas, 100 miles east-northeast. Several newaspapers in this section carried reports of a falling plane on that day. One report went so far as to describe it as "a big aluminum colored monoplane." Another report was that a burning plane was seen to fall.

The stone has the characteristic crust and pitted surface. It has an oblong shape. The burned crust is about half a millimeter in thickness. The actual weight is 2275 grams and its specific gravity is about 3.5, water standard. When the stone was placed in water, in measuring the specific gravity, streams of small air bubbles issued from six places on the surface and continued to issue as long as the stone was under water, for about two minutes. It was estimated that the stone soaked up about 8 grams of water during the two minutes.

Six days after the observed fall, another stone weighing 108 grams was found about three and a half miles northeast from the place of fall of the five pound stone. It was found accidentally by John Moore a hundred yards from his house. He was walking in his back yard when he noticed a new small hole. With his walking stick he pushed more dirt away and uncovered the small stone which had little more than buried itself in rocky ground. Some small pieces were chipped from this meteorite on landing. The condition of the hole and the ground around indicated that this stone had fallen at the same time as the larger stone.

The surface of the small piece is not burned so much. Two faces of this are burned less than the rest of it, indicating that this was broken from another piece after burning started. These two faces show considerably rougher edges partly burned.

These two pieces are the only ones recovered so far from the fall, though considerable search has been made of the places in that vicinity. They are now the property of the University of Arkansas and will be on display in the new museum when it is completed this summer.

DAVIS P. RICHARDSON.

University of Arkansas, Fayetteville, Arkansas.

Notes from Amateurs

Astrolab Observing Program

The above is the title of a twelve page mimeographed pamphlet recently issued by the Astrolab society, an organization of amateur astronomers with headquarters at Morgan Park, Chicago, Illinois. This pamphlet is devoted largely to the matter of coöperative meteor observations. A schedule of nights during the summer fav-

orable to meteor work is given. It contains also comments from several recognized authorities on meteors relative to the equipment needed and the procedure to be followed in such work. There are diagrams and descriptions of instruments which this society is developing.

Amateurs with telescopes or without who wish to join in such coöperative work will be welcomed and instructed upon application to L. I. Buttles, 10728 South Artesian Avenue, Chicago.

The Toledo Astronomical Society

An unusual meeting was held by the Toledo Astronomical Society Thursday evening, April 11, in the Hall of the University of Toledo. The program consisted of demonstrations in high frequency currents by Professor Karbler of the Physics Department. The demonstration of a Lesla and an Oudin coil attracted the greatest attention.

W. Albert Hiltner, *Secretary.*

2212 Grantwood Drive, Toledo, Ohio, April 22, 1935.

Amateur Telescope Makers of Chicago

The Amateur Telescope Makers of Chicago held their monthly meeting at the Adler Planetarium and Astronomical Museum, Chicago, on Sunday, May 4.

The program was a discussion of the "Problems of the Amateur Telescope Maker" lead by Charles W. Eliason, Jr. Mr. Eliason gave a summary of the process of making a telescope, from rough grinding to designing the mounting. A number of questions were discussed including the relative merits of H. C. F. and pitch laps. The conservatives decided that there was nothing like pitch and the H. C. F. men were glad that there wasn't, so every one was satisfied. The depth of the shadows in parabolizing mirrors of different focal lengths came up for treatment. In making their first F8 mirror most of the members had judged by the shadows and found their mirrors over corrected. It is important to be guided by zonal tests instead of the appearance of the shadow. The importance of a steady mounting was emphasized as that is another pitfall for amateurs. The use of a helical slot in the adapter for sharp focusing was described. Most of the members are having their mirrors aluminized as it is found to be much better than silver in the Chicago atmosphere.

The next meeting will be on Sunday, June 2, at 2:00 P.M. in the Planetarium. G. E. McCord will give an illustrated talk on Sun Spots.

1319 W. 78th Street, Chicago, Illinois. Wm. Callum, *Secretary.*

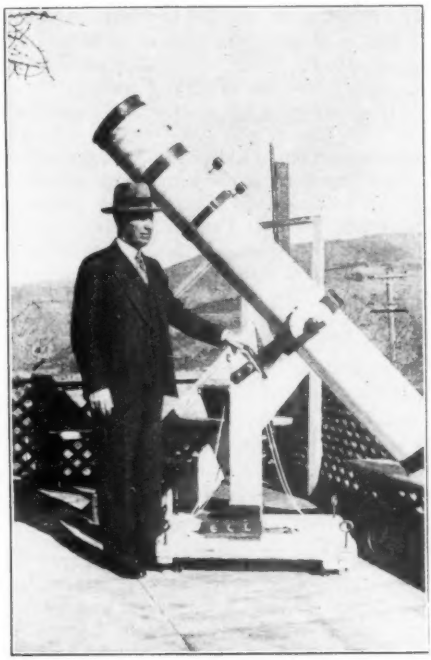
An Amateur's Telescope

My telescope, a 10¼-inch reflector of 90-inch focal length, is equatorially mounted on a movable platform. The 12-inch tube is attached to a 6-inch by 6-inch upright post by two iron U's which give easy movement, with circles in Right Ascension and Declination, but without slow motion.

I was greatly handicapped in making the mirror by the fact that I had never seen any one work with glass, and I did the work at my Santa Cruz Mountain cabin where there was no one to consult. I had no lathe and very few tools. All my instruction was obtained from two books. The better book was made up of independent articles by ten or fifteen writers. There was no continuity, and many details were omitted. Before beginning to work I wrote out in longhand eighteen pages of instruction, listing the material and tools needed, and numbering every

step in order from the preparation of the grinding post to the final step in figuring.

At each wet in grinding and polishing I got everything ready for the stroke, and then recorded the time. When the wet was finished I again recorded the time. This gave the actual movement time of the wet. No account was kept of the time for preparation, or of making tests. Rough grinding took 472 minutes divided into 42 wets. Fine grinding, 98 minutes, 16 wets. Polishing, 108 minutes, 18 wets, and figuring 201 minutes, 24 wets. Total actual movement time, 14⅜ hours.



MR. J. B. DURYEA AND HIS TELESCOPE.

When ready to polish I made a pitch lap, but while cutting the V-shaped channels the lap broke so badly that it was worthless. Then I made a HCF lap on which I polished and figured. I have since talked with amateurs who have made many laps for one mirror. In one case twenty laps had been made for a 6-inch mirror—and six months' time wasted. I saw the young man at work on figuring in this case. He was using rough paste at least a thousand times as thick as I used in the same stage and his wets were just five times as long as mine. I think that an amateur's success comes from using extreme care. I was so careful that I was fussy. But I have a mirror that is true to the extreme edge and without a scratch or pit that a microscope can find. No mat is needed to cover the edge.

The second book I used advised making a 10-inch instead of a 6-inch mirror, and stated that just as valuable experience could be obtained from the larger

glass, and, if successful, the instrument would have 78½ instead of 28¼ square inches of light gathering surface. The difference is well worth working for.

The final stages of figuring were like a mystery story. I had never seen any one make a Foucault knife-edge test and I had only a faint idea of the appearance of a paraboloidal shadow. After many tests the mystery was still unsolved, so I turned to measurements. When the focal length of the edge of the mirror (at center of curvature) was one-seventh of an inch longer than that of the center I stopped and called it a day.

I silvered and lacquered the mirror, and two years ago I had it resilvered, and it is still good. I used a 1½-inch prism instead of making a diagonal. I have six eyepieces, giving 45, 60, 90, 135, 180, and 270 magnification. The finder and rack and pinion eyepiece holder are as crudely made as the mounting, but they answer very well. The materials used (excluding the prism and eyepieces) cost about $65.

The telescope is mounted on a rigid pedestal which can be rolled to either of two platforms on which lines running north and south are painted. When leveled and otherwise carefully adjusted it is ready to use. By the use of the setting circles a distant galaxy, or Venus at 1:00 P.M., is easily found.

The telescope has good definition. In fact, I saw the white spot on Saturn in 1933, as well as Cassini's dark division in Saturn's rings. I can separate some rather close doubles and see stars a little fainter than 14th magnitude. I have observed and recorded about a hundred nebulae and star clusters, and have seen several stars and the large planets during the daytime. I enjoyed the work of making the telescope as much as I have enjoyed observing the beauty spots of the sky since its completion.

J. B. DURYEA.

1700 Jones Street, San Francisco, California.

Asteroid Notes

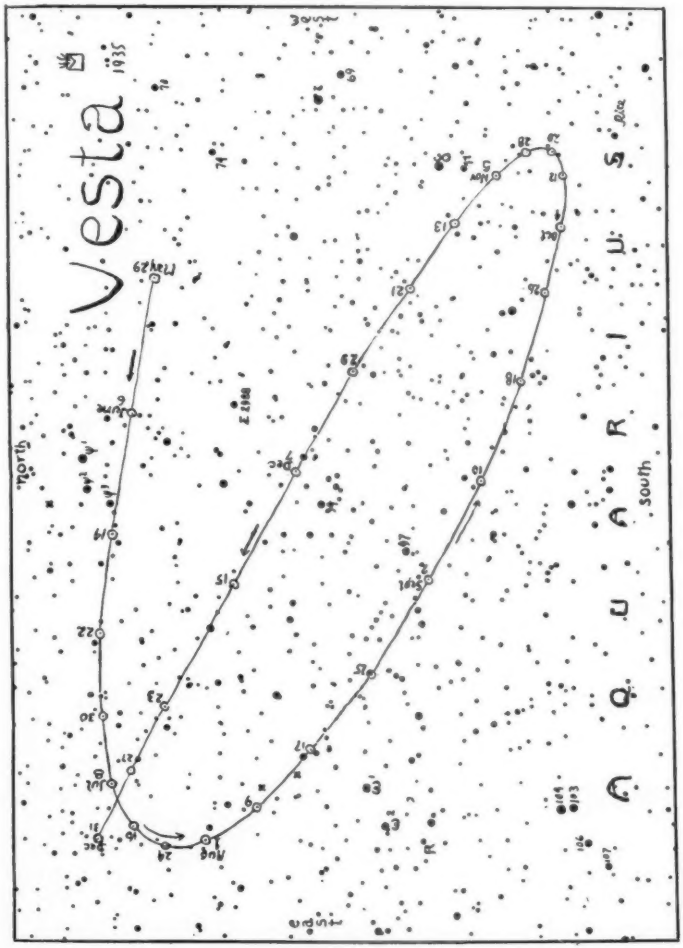
By HUGH S. RICE

Bulletins are continually received at this office from the *Astronomisches Rechen-Institut*, the minor-planet clearing house in Dahlem, a suburb of Berlin. The text of these bulletins comes in 5 languages, which are, in their order of frequency, German, French, English, Spanish, and Italian. They are not at all bulletins of the sensational news type, but consist mainly of tabular material, and the following list comprises the chief topics:

a. Photographic observations of asteroids, with the planet's name, date, plate number, exact position in R.A. and Decl. [as "reduced"], magnitude, correction [observed minus computed place], observer, observatory, special notes
b. Ephemerides for new planets, with all the necessary data
c. Corrected or improved ephemerides
d. Names given to new planets
e. Asteroids of which observations are specially desired
f. Identifications of observed asteroids with known ones. According to Professor Leuschner, there are probably 50,000 asteroids, and of this number perhaps 5000 have been observed by astronomers. And we find that over 1300 are well enough observed (as shown by data gathered by the R.-I.) that they can be said to be well known to the astronomical world.

Vesta, our brightest asteroid, performs such a neat retrograde loop during the second half of this year that we are able to represent in one picture its path

among the stars for the entire period. It will be seen that its course lies in one constellation, Aquarius. On June 7 the magnitude is $7^{M}.2$, which improves with time, becoming $6^{M}.5$ at the end of the period of this issue, August 10. It can therefore be picked up with low optical power. Along Vesta's path lie numerous



stars, such as ψ^{3} Aquarii and another near the date August 17 on the chart, which will form very close conjunctions with the planet. Motion of the asteroid among the stars can at such times be detected even in small instruments, in the course of an evening's observation. First locate with naked eye the star δ Aquarii, and after sighting on this, move the telescope field nearer the asteroid track. The

diagram is to be inverted as usual (at the telescope) with the "south" pointing to the north celestial pole. The positions are for 7:00 P.M., E.S.T., of the days marked, and the plotting is based upon ephemerides from the *British Astronomical Association.*

American Museum of Natural History, New York, May 18, 1935.

Communications and Comments

Under this heading we shall publish from time to time such material as does not properly fall under any of the established headings of this journal. Here, too, may be found, when occasion arises, articles which the editors may not be willing to give sanction to but which, nevertheless, may be provocative of thought along new lines.

A Novel Comet Theory

Authorities attribute a comet's tail to particles of matter being forced from the comet by light from the sun, not because the theory is especially convincing, but because it is the most plausible explanation of the phenomenon yet proposed.

May not the tail be due to forces generated by curvilinear motion? Since, according to the curvilinear-motion theory, the tails of comets and the tides caused by the sun are similarly produced, let us review the accepted theory of the solar tides.

The earth is propelled through space by a projectile force which tends to move it forward in a straight line, and by a centripetal force which tends to pull it to the sun. The projectile force may be resolved into two components, one of which, termed centrifugal force, tends to move the earth from the sun, opposing the centripetal force, it being these two forces, centripetal and centrifugal, that hold the earth to its orbit, permitting it to swing neither inward nor outward from its never varying elliptical path. Since the centripetal force thus applied to the earth varies as the mass and inversely as the square of the distance from the sun, whereas the opposing centrifugal force varies as the mass and directly as the distance from the sun, the major portion of the centripetal force of the earth is applied to its illuminated half, while the major portion of the opposing centrifugal force is applied to the nocturnal half. Now, with the earth held to its orbit by its centrifugal and centripetal forces, but with the major portion of its centripetal force tugging at its illuminated half, tending to pull it to the sun, and with the major portion of its centrifugal force tugging at its nocturnal half, tending to force it from the sun, the earth is subjected to an elongating pull. With our watery globe responding to the pull, and with the globe rotating on its axis, the solar tides result.

Since, like the earth, every heavenly body is propelled through space by a projectile and a centripetal force and is, therefore, held to its orbit by opposing centripetal and centrifugal forces, it follows that every planet, planetoid, comet, satellite, and sun is similarly subjected to an elongated pull. The strength and effectiveness of the pull differ greatly with the different bodies, depending on factors hereinafter discussed.

As the elongating pull of a heavenly body is due to its parts being at different distances from the center of attraction about which they revolve, the diameter of a heavenly body is one of the factors that determine the degree of elongation.

The law relating to the diameter may be thus stated:

Principle 1. Other factors being the same, the elongating pull to which a heavenly body is subjected is proportional to that diameter that is in line with the elongating pull.

Again, were the earth to pass as close to the sun as do tail-producing comets, it would doubtless be disrupted and greatly lengthened by its elongating pull, for the centripetal and centrifugal forces would be multiplied many fold. The law relating to the distance from the controlling center of attraction follows:

Principle 2. Other factors being the same, the elongating pull to which a heavenly body is subjected is inversely proportional to its distance from the center of attraction about which it revolves.

Note that compared with the earth, tail-producing comets are great in diameter, factors that make for elongation according to Principles 1 and 2.

True, because of the small mass of a comet its elongating pull is inconceivably weak compared with the force that produces the solar tides. But so great is the attraction of the earth that producing the solar tides requires an elongating pull capable of raising billions of tons of water considerably above the normal oceanic level, whereas so weak is the attraction of a comet that its usual globular form is lengthened by the slightest elongating pull. It cannot therefore be said that a comet is less elongated than it would be if it were made up of denser, equally mobile matter.

Let us now consider the changes that occur in a tail-producing comet when it passes from aphelion to perihelion.

At aphelion, where according to Principle 2, the elongating pull is weakest, the comet is assembled by the attraction of its mass into globular form, with its denser materials, the nucleus, at its center.

As the comet speeds toward the sun its elongating pull strengthens in accordance with Principle 2. It also strengthens in accordance with Principle 1, to the extent that the comet is lengthened by the pull, the phenomenon being unique, in that it is a case of a cause, the elongating pull, and its effect, the lengthening of the comet, mutually and simultaneously augmenting each other. When one comprehends the principle underlying the phenomenon the great length attained by a comet becomes less of a source of wonderment.

Another elongating factor to be considered is the shifting of the nucleus toward the comet's inner end, the end directed toward the sun.

While the comet is on its inward journey its centripetal force, of course exceeds the centrifugal force or it would not be moving toward the sun. The nucleus is accordingly drawn from the center of the comet toward the sun by the superior centripetal force. This movement of the nucleus is, however, soon arrested by the combined resistance of the centrifugal force and the attraction of the comet's mass.

Again, as a tail-producing comet nears the sun, not only is its centrifugal force heavily concentrated at its outer end, but its centripetal force is much more heavily concentrated at its inner end, due to its being distributed throughout the comet's mass in a geometrical series while the centrifugal force is distributed in an arithmetical series. And the nucleus, being off the comet's center and relatively near the concentrated centripetal force, is accordingly dominated by it and drawn toward the inner end of the comet.

Furthermore, as a submarine ascending from the depths of the ocean, displaces the surface waters above it, which seek their equilibrium by flowing in all directions, so the nucleus approaching the inner end of the comet displaces its

surface gases which seek their equilibrium by flowing along all sides of the comet toward its outer end. This sliding sleeve of gases, replenished and propelled by a continuous displacement of gases, soon comes within the influence of the heavily concentrated centrifugal force, and it is projected beyond the main body of the comet in the form of a hollow protuberance or tail.

This welling up of gases at the inner end of the comet and their movement along the sides of the comet and their formation into a hollow tail, has long mystified comet observers.

This tail-forming process continues with increasing rapidity until the comet passes perihelion, when its elongating pull weakens in accordance with Principles 1 and 2, and the attraction of the comet's mass again becomes the dominant force and again assembles the comet in globular form with the nucleus at its center.

To be thus elongated and be again restored to globular form, the comet must, of course, hang together. Were it to separate Principles 1 and 2 would apply to each separate body but not to the entire comet as a unit. Has a comet sufficient attraction to resist its separation if and when subjected to so potent a force? Let us see.

If Halley's comet were at rest and the only matter in existence and the laws of matter would still hold, the comet, if elongated, would be assembled by the attraction of its mass in globular form. And the movement would be as positive and as swift as it would be if the body were a mass of shot as great in volume as the comet and similarly elongated, for a comet is as effective in assembling the comet as the shot would be in assembling the shot. This follows from the fact that both the attraction of matter and the force, required to overcome the inertia of matter, vary as the mass.

Moreover, an elongated comet is more resistant to separation when revolving about the sun than under the hypothetical conditions just stated, for, with the tail pointing from the sun, not only is its separation resisted by the attraction of the comet, but also by the attraction of the sun, the two forces being nearly in line. When the tail attains its maximum length, it is reeled in by the combined pull of the comet and the sun as fast as the weakening of the opposing elongating pull allows. A comet is sometimes separated by external forces, but never by forces generated within it by curvilinear motion.

To understand how centrifugal force projects the sliding sleeve of gases beyond the main body of the comet, it must be borne in mind what has already been pointed out, that the tail, throughout its entire length, is securely tied by attraction to the comet's head. With the head swiftly rounding the sharp curve forming the end of the comet's eccentric orbit, the tail is swung like a lash through the vacuum of space, the principle underlying the swing of the lash and the swing of the tail being the same. Note that the swing of the lash, like the swing of the tail, is produced by its inner end being swiftly forced about a sharp curve. And note that centrifugal force is the projecting force, projecting the lash through resisting air and the tail through unresisting space.

With this theory, as with the one generally accepted the difficult task is to account for comet tails that point in other directions than from the sun, recorded instances of which, though rare, are not wanting.

SETH S. AVERY.

Angola, Indiana.

On the Origin of the Solar System

When Pluto was found in 1930 this new planet proved too small for ordinary amateur telescopes, so we amateurs, instead of observing the planet, set to work on the theory of the planetary distances. In this way several systems of planetary progression were developed, some of them appearing in the pages of this magazine in 1930 and 1931. And as we at that time tried to suit our lawful distances to the actual ones in the solar system, some of us found that Saturn did not behave as well as some of the other planets. Finally the question was asked, is Saturn a stranger in the solar system?

One might as well have asked, is the tidal theory of the origin of the solar system wrong? For if the planets, as the tidal theory implies, are condensations from the stuff in the tidal wave that was raised on the surface of the sun and finally torn from it by the gravitational pull of a passing star, then all the planets are of the same age and are built from the same material. Assuming that the planets came into being a couple of thousand million years ago or more, we may concede that the sun at that time was not as dense as it is today; and, if the stuff drawn from the sun was taken mainly from the surface layers of the great luminary, the density of the planets at birth was probably less than that of water.

As time went on the planets cooled and contracted, the density grew greater, and today they are all heavy enough to sink in water—except Saturn. A reasonable explanation of the lightness of Saturn could possibly be formed if the ringed planet were the largest one in the solar system. But that honor we must give to Jupiter.

And there are other phenomena pointing to the same conclusion, that all is not as well in the solar system as it ought to be if the tidal theory is correct. Take for instance the dense atmosphere of Venus, or the "cloud-layer" of that planet. As Venus is not quite as heavy as the earth, the "lawful" atmosphere of this planet should be somewhat lighter than the air surrounding the earth. But if we could see Venus and the earth simultaneously from the same distance in space, then it would appear that the earth had lost more of its atmosphere than Venus.

We cannot always believe our eyes, however. And still we feel that our present knowledge of the solar system is insufficient to form a satisfactory theory of the birth of the planets. Those having access to telescopes of sufficient power to show Pluto, seem to agree that this planet shows low albedo and a yellowish tint. But if Pluto is of the same size and mass as the earth, or even a little smaller or larger, why should it have lost most of its atmosphere if it be no older than the earth?

Other things in the solar system could be mentioned in this connection. But the space in a monthly magazine is limited, and this short paper will be summed up by saying that the origin of the solar system may not be as well taken care of by the tidal theory as we thought only a few years ago.

Kreftings gt. 5, Hønefoss, Norway. HANS A. ERIKSEN.

Zodiacal Light Notes

By FRANKLIN W. SMITH

The evening Zodiacal Light was observed at 8:40, E.S.T., on April 25. Its northern edge was traced through points a few degrees north of β Tauri, between Castor and Pollux, and about half-way between γ and ι Cancri, respectively. The southern edge was traced through χ_1 and χ_4 Orionis, ν Geminorum, and south of ξ Cancri, to η Leonis which marked the apparent apex of the light cone. The

axis of the cone was therefore a few degrees north of the ecliptic and the elongation of the apex from the sun was about 114°. On April 30 the boundaries of the light cone were nearly the same as those just described except that the apex was a few degrees farther east.

The sky was exceptionally clear on the morning of May 8 and the morning Zodiacal Light was seen at 3:00, E.S.T., although the angle between the ecliptic and the horizon was of course nearly at its minimum value at the time. The northern edge was just south of α and β Aquarii and the southern edge passed through δ and γ Capricorni. The apparent apex was just east of β Capricorni. The axis of the cone was therefore slightly north of the ecliptic and the apex was about 74° west of the sun.

407 Scott Avenue, Glenolden, Pennsylvania, May 17, 1935.

General Notes

Professor Edwin Brant Frost, director emeritus of the Yerkes Observatory, died at the Billings Memorial Hospital, Chicago, on May 14, 1935, after a brief illness. He was sixty-eight years of age. An account of his extensive contributions to astronomy will be given in a coming number of this magazine.

Mr. Newton L. Pierce, who has been an instructor in astronomy at Dearborn Observatory of Northwestern University for several years, has resigned to accept an assistantship at Princeton for next year. He will continue graduate work leading to the degree of Ph.D. Mr. Arthur R. Sayer, who will receive his degree from Harvard this spring, will take Mr. Pierce's place at Dearborn in September.

The Rittenhouse Astronomical Society, of Philadelphia, conducted the first of a series of Constellation Studies on Friday evening, May 24, in Fairmount Park. This society is fortunate, being in a city, in having such a large open space near at hand.

Cleveland Astronomical Society.—The regular meeting of the Cleveland Astronomical Society was held May 17, 1935, in the lecture room at the Warner and Swasey observatory of Case School of Applied Science.

Dr. Nassau, Director, on whom most astronomical activities in this section devolve, opened the meeting. New officers were elected as follows: President, Dr. J. J. Nassau; Vice President, Carl M. Yoder; Secretary, Roy Gordon; Treasurer, Mrs. H. T. McMyler; Chairman of Executive Committee, Sheldon Towson. Dr. C. H. Cleminshaw then gave a very interesting lecture on the planets visible in the evening sky, illustrated with lantern slides.

The members then adjourned to the dome where these celestial objects were viewed through the large refractor in charge of Philip Taylor. It was decided to arrange a picnic meeting during the summer months to which the members can bring their own telescopes for evening observing.

Don H. Johnston.

14 Lincoln Drive, Cleveland, Ohio.

Perkins Observatory.—An agreement has been reached between Ohio Wesleyan University and Ohio State University for the joint operation and use of Perkins Observatory. Both parties contribute toward the observatory budget. The

Director of the observatory is appointed by the joint action of the Boards of Trustees of both institutions. The management of the observatory is in the hands of a committee in which both universities are equally represented.

This agreement contemplates an extension of the activities of the observatory in its research and general educational work.

Stratosphere Balloon to be "Surveyed" to Check Altitude on Coming Flight

Contributed by SCIENCE SERVICE

The nation's system of topographical surveying criss-crossing the country like an invisible giant fish net will help check the altitude of the Explorer II, giant stratosphere balloon of the National Geographic Society-U. S. Army Air Corps, when it takes the air next month, according to an announcement from the Society's offices here.

In unprecedented degree the altitude of the flight will be accurately checked from a multitude of ground stations along the path of the aerial trip by a corps of volunteer surveyors who will take up stations at the Federal "bench marks." These bench marks are bronze markers spaced 30 miles apart throughout the Plains region which are the key points in the nation's system of topographical survey. The exact positions of the markers are known with great accuracy and from them the surveyors, with transit telescopes, will be able to make measurements on the altitude of the balloon every fifteen minutes while it is in view.

Equipped with automobiles having radios, special code signals will be broadcast every fifteen minutes, at which time all the surveyors in sight of the balloon will take readings on its stratospheric positions. By trigonometry these readings can be translated into elevation above the surface of the earth. These observed altitudes can be checked with the sealed barographs aboard the Explorer II and thus check the accuracy of these instruments at high altitudes.

A third check on altitude at every instant will be the great aerial camera taking photographs of the ground below the balloon at frequent intervals which worked so well on the last flight. The one hitch in this valuable scheme was that the distance between points on the ground (hill tops, valleys, etc.) must be accurately known to calculate the balloon's height from the photographs. This is not always possible, since some of the regions over which the balloon flies have not yet been surveyed with the desired accuracy. Using the three systems in combination, however, an exceptionally accurate height determination is expected.

Washington, D. C., May 15, 1935.

Occultation of Venus, May 5, 1935

This occultation was observed at Goodsell Observatory. The telescope used was the 8-inch Clark refractor stopped down to 3.3 inches. Power 80, seeing 1 on scale of 5.

First contact	$17^h\ 47^m\ 36^s.3$ C.S.T.
Disappearance	17 48 27.2
Third contact	18 36 32.1

The times of first and third contacts are probably correct to one second while the disappearance of the last ray of the illuminated surface is believed to be correct to about $0^s.2$. The end of the emersion of the illuminated surface of the planet was not timed as the seeing was too bad at the time.

E. A. FATH.

Northfield, Minnesota.

Book Reviews

The Seven Seals of Science, by Joseph Mayer. (The Century Co., New York and London.)

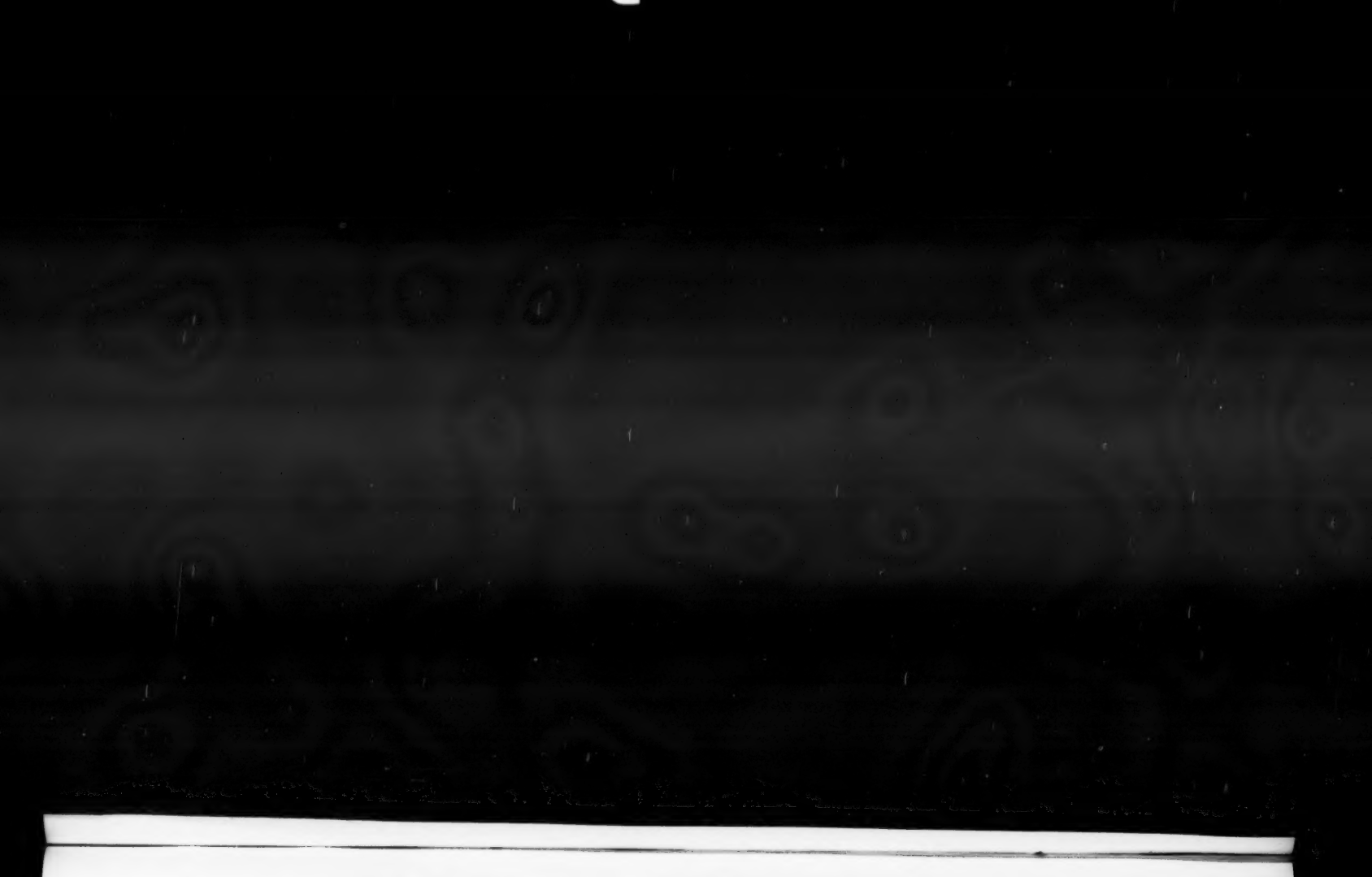
Within the limited space of a little over 400 pages the author traces the development of seven sciences (mathematics, astronomy, physics, chemistry, geology, biology, and psychology) from their earliest beginnings up to the present time. Dr. Mayer makes the point that these seven sciences could not have come into existence at the same time and developed simultaneously down through the centuries, but that some had to precede others. Mathematics was established first, followed next by astronomy and physics, then chemistry, geology, and biology, and lastly psychology.

The book not only shows the gradual and inter-allied growth of these seven sciences, but does this against an historical background of world events which is most interesting and helpful. The author very successfully condenses a vast amount of material into a limited number of pages. He paints a large canvas not a fine, detailed miniature. Some 40 photographs and drawings add greatly to the book's merit. In all, "The Seven Seals of Science" is a book that one feels is well worth reading. F.L.S.

Through Space and Time, by Sir James Jeans. (The Macmillan Company, New York. $3.00.)

In recent years there has been a growing demand for information concerning the findings of science stated in non-techical language which the average intelligent reader can understand and enjoy. Newspapers and magazines are making commendable efforts to meet this demand with considerable success, but there is frequently the problem of separating the wheat from the chaff.

Several men of science of high rank have been eminently successful in writing books on the findings and applications of science in non-technical style for the average reader. Sir James Jeans stands pre-eminent in this group. His previous books, "The Mysterious Universe," "The Universe Around Us," and "The New Background of Science," have been highly illuminating and were read with great interest. But in his new volume, "Through Space and Time," the author has attained his greatest success. He pictures in eight chapters the Alpha and Omega of the Earth, the Air, the Sky, the Moon, the Planets, the Sun, the Stars, and the Nebulae, in relation to time and space. The reader marvels at the clear and simple language in which the great discoveries in all these fields are told. There is no mathematics other than some very large numbers representing time and space in relation to these subjects. The vast conceptions which stagger the imagination are illustrated with simple homely analogies which are almost amusing in their simplicity.

The volume is illustrated with fifty-three plates of remarkable photographs, beautifully reproduced. It represents high grade workmanship throughout. It is a book which the reader, when he has read it, will be glad to place upon his shelf as one of his friends. It is altogether a delightful book which enlarges the reader's intellectual horizon and increases his humility and reverence as he contemplates the Universe in which he lives.

FRANZ F. EXNER.